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SURVEY TO DETERMINE THE DEMAND SITUATION
FOR IMPORTED AND DOMESTIC MOULDING AND CORE
SANDS USED BY CANADIAN FOUNDRIES AT PRESENT
AND FOR THE PAST FIVE YEARS AND NEXT TEN YEARS

DRAFT

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SUMMARY

The main objectives of this study is to develop data on the consumption of moulding and core sands by Canadian foundries. At the present time, about 93% of these materials are imported - almost all from the United States. The consequent high transportation costs and the unfavourable exchange rate make it difficult for Canadian foundries to compete in domestic as well as foreign markets. This also holds true for other Canadian industries for whom castings represent a major cost component.

Data on past, present and future consumption were collected by means of questionnaires, visits and meetings. Information obtained from foundries was supplemented with data received from sand suppliers and government sources. It is estimated that the average annual consumption of moulding and core sands was 713,000 tons in the five years from 1977 to 1981 inclusive; and will be 467,500 tons in 1982. Projections for the ten years 1983-1992 were based on questionnaire responses and information from suppliers. They were then adjusted for expected economic and technological trends. The average annual consumption for the next 10 years is expected to be 559,000 tons. Foundries in the Prairie Provinces and British Columbia are expected to use more sand in the future than in the past. Consumption in the other parts of Canada is not expected to regain the 1977 to 1981 level.

Sand from the Ottawa District in Illinois sets the North American standard for quality, and is used throughout Canada. However, it is second in quantity consumed to Lake sand which is used mainly by the iron foundries of Southern Ontario.

Olivine is the most extensively used non-silica sand. It is expected that the annual consumption of this material will grow from 16,000 tons in 1977-1981 to about 25,000 tons in 1983-1992.

There are eight active domestic suppliers of silica sands. The most significant is the Selkirk Sand Division of Steel Brothers Canada Ltd. Silica sand from their deposit on Black Island in Lake Winnipeg is processed at Selkirk, Manitoba and distributed throughout the Prairie Provinces. Their quality approaches that of Ottawa District sand.

The other domestic producers service only local markets with lower quality materials.

Olivine sand is imported from Washington State and North Carolina. Chromite is brought in from South Africa and Rhodesia. Most of the Zirconite sand comes from Australia.

The costs of moulding and core sands are made up of:

- (a) Sand cost - raw material
- (b) Processing - washing, drying and screening
- (c) Packaging - where necessary
- (d) Transportation

All of these components vary with the amounts purchased, the quality required, the processes used in the foundry and the facilities they have for receiving, handling and storing sand.

Most of the sand is purchased from the U.S. suppliers by Canadian distributors and resold to foundries. In most cases, the distributors add value by processing and/or packaging. Thus, the final cost to the foundry varies a great deal from foundry to foundry, and it is impossible to partition all the costs into Canadian and U.S. components.

Some of the larger foundries receive raw or processed sand directly from the U.S. suppliers, with the distributor acting solely as a broker.

The general trend has been for transportation costs to escalate far more rapidly than the material costs.

A typical grade of Ottawa District sand costs about \$12 per ton at the source. Transportation costs in 100 ton rail cars vary from \$36 per ton in Hamilton to \$78 in Vancouver. Raw lake sand shipped by boat to Hamilton and processed in Hamilton costs about \$18 per ton. Transportation by truck to a Hamilton foundry costs \$4 per ton. Selkirk sand costs about \$31 per ton with a transportation cost of about \$46 to Saskatoon.

Typical total costs are as follows:

Ottawa District Sand in Hamilton	-\$52/ton
in Vancouver	-\$90/ton
Lake sand in Hamilton	-\$22/ton
Selkirk sand in Saskatoon	-\$77/ton

Imports of silica sand for foundries increased from 607,400 tons in 1977 to 800,500 tons in 1979. This decreased to 542,300 tons in 1980 and 519,750 tons in 1981. In the first eight months of 1982, a total of 227,700 tons were imported. The average declared value of the material increased from \$6.26 per ton in 1977 to \$12.97 per ton in 1982.

Foundry sand makes up about 40% of total silica sand exports and only an insignificant proportion of domestic production.

The current depressed state of the economy which worsened during the time of the study obviously affects the projections of future consumption. However, bearing in mind that the largest markets for castings are the automotive, agricultural, mining and transportation industries, there are

no valid reasons for the foundry industry to expect to regain its former level of production in the near future.

The growing trend to sand reclamation and conservation will in effect reduce the amount of sand consumed per ton of castings produced. Even when the foundry production reaches its pre-1982 levels, sand consumption will not.

It can be expected that domestic production of moulding and core sands will grow at a higher rate than imports. However, this will require cost reduction in some cases and quality improvement in others. There are several attractive potential domestic sources of silica, olivine and chromite sands.

More foundries will invest in improvements to their sand handling and storage facilities to decrease the transportation and packaging charges.

There are no published or official standards commonly used to purchase foundry sands. In most cases foundries purchase by type or source to define quality and general characteristics, and then specify grain fineness and screen distribution to suit their operations.

Supplies of moulding and core sands for Canadian foundries are secure and transportation routes are well established.

The following measures are recommended:

- (a) Cost reduction for domestic sands
- (b) Feasibility studies to upgrade local sources
- (c) Feasibility studies to develop silica sand sources on or near the St. Lawrence Seaway
- (d) Assistance to Canadian foundries who wish to improve their facilities for handling and storing sand

- (e) A high priority should be given to developing a domestic source of olivine for both the Canadian and U.S. markets
- (f) Feasibility studies to develop the chromite deposits in Newfoundland or Manitoba to supply the foundry and general metallurgical markets.

1. INTRODUCTION

1.1. Objectives

The primary objective of this survey is to collect and interpret data concerning the consumption of moulding and core sands by the Canadian foundry industry. The results of this survey should provide a basis to determine the need for, and the feasibility of, new or expanded domestic sources of supply.

1.2. Background

Most of the moulding and core sands consumed by Canadian foundries are imported from the United States. Foundry sand production generally requires a heavy capital investment, not only for the mine property and mining equipment, but also for the processing plant. The latter is required to process the sand so that it can meet foundry specifications. Requirements vary for each foundry, depending on the type of metal poured, the size of the castings, the level of quality and the processes used to produce moulds and cores.

The high capital cost incurred to serve a relatively small, widely dispersed and highly segmented market has tended to inhibit the development of Canadian supplies.

Foundry sand is a low-priced bulk commodity and for almost all Canadian foundries the cost of transport far exceeds the cost of the material. In recent years, freight charges have increased much more rapidly than the price of the sand itself. This trend coupled with the unfavourable exchange rate, has had a serious and growing effect on the ability of Canadian foundries to compete in both the export and domestic markets.

Although silica sand is produced commercially in almost every province, most of the production is for markets

other than the foundry industry. The quality requirements of some of these markets, such as the glass industry, are at least as stringent as those of the foundry industry. However, both the quality and quantity requirements are well established and relatively uniform. This has not been the case for foundry sands.

1.3. Scope and Terms of Reference

1.3.1. For the purpose of this survey, sand will be defined as the fine granular material naturally or artificially produced by the disintegration or crushing of rock or other mineral material. All the particulate mineral materials used to make foundry moulds or cores will be included. Although silica materials predominate, extensive use is also made of zircon, olivine and chromite sands.

1.3.2. Generally speaking, the materials other than silica are more expensive and are only used for certain technological advantages they provide. However, in some cases (ex. olivine in B.C. foundries) the non-silica material is cheaper due to lower freight costs. A distinction will be made between the two situations to ensure that the projections reflect real opportunities.

1.3.3. All types of foundries using sand moulds and cores will be included.

1.3.4. The survey will cover all provinces.

1.3.5. Data will be collected for the current year (1982) and the previous 5 years. These will be broken down by source, chemical composition, grain size and grain shape.

1.3.6. Projections of foundry sand consumption for the next 10 years will be broken down by province, type of foundry, sand chemistry, grain size and grain shape. This will obviously also require projections of foundry activity over the same period.

1.3.7. Future technological and economic trends which can affect the amount of sand that is consumed will be considered in developing the above projections.

1.3.8. Current Canadian sand producing operations and known potential deposits will be reviewed to develop recommendations for future feasibility studies.

1.3.9. These recommendations will include potential combined operations with compatible products. For example, a Western Canadian operation which could supply both the fracturation, and foundry markets or another operation which could produce both glass and foundry sands.

2. METHODS

2.1. Foundry Questionnaires

A mailing list (shown as Appendix 1) was developed to cover all active Canadian foundries, excluding die and investment casting plants. The primary source was a list developed for a previous study^{(1)*}. This was brought up to date with information from trade associations, suppliers and government agencies. A total of 285 active foundries were identified. These were distributed as follows:

<u>REGION</u>	<u>STEEL</u>	<u>IRON</u>	<u>NON-FERROUS</u>
Atlantic	1	11	4
Quebec	7	31	25
Ontario	12	71	67
Prairies	4	17	8
British Columbia	7	7	9

The questionnaires (Appendix 2) were mailed out during the month of August. After a suitable period had elapsed, a telephone follow-up procedure was initiated to encourage more response. In some cases, the information was received by telephone.

Subsequent analysis of the questionnaires revealed a number of ambiguities. These were resolved during a second telephone follow-up campaign.

A summary of the questionnaire data is shown as Appendix 4.

It should be noted that many foundries produce more than one type of metal (ex. iron and bronze). In such cases, they are listed under their major product.

* Numbers in parentheses refer to the list of references on page 40.

2.2. Supplier Questionnaires

A questionnaire was sent to selected major Canadian suppliers or distributors of foundry sands. A sample of the questionnaire and its covering letter are shown in Appendix 3.

The suppliers were asked to provide a list of the foundry sands they sell or distribute as well as estimates of the foundry sand market in their region.

Some of the eleven firms returned their questionnaires and other preferred personal discussions.

2.3. Visits

2.3.1. Foundries

Visits were made to eleven foundries in Vancouver, Winnipeg, Southern Ontario, Montreal and the Quebec City region. The purpose of these visits was to gather more detailed information on trends in sand consumption and costs.

2.3.2. Suppliers

Meetings and telephone interviews were held with major sand suppliers in Vancouver, Edmonton, Winnipeg, Hamilton, Toronto, Montreal and Troy, Michigan. The purpose was to develop background information on the sand trade, sand markets and future trends. In addition, the individuals contacted were able to provide estimates of sand consumption by foundries who did not return a questionnaire.

2.4. Other Sources

2.4.1. Government Officials

Appropriate officials in various provincial and Federal agencies provided copies of reports and statistics dealing with sand consumption and trade.

2.4.2. Trade and Technical Associations

Trade and technical associations provided background information to assist in projecting the future demand for moulding and core sand.

2.4.3. Files

Background information on the types and amounts of sand consumed by various foundries was collected from our project files.

3. ANALYSIS OF THE QUESTIONNAIRE DATA

3.1. Significance

A total of 122 foundries responded to the questionnaire. This represents 42.5% of the total number of foundries. However, when examined on the basis of sand consumption, the response was much more significant. The total sales of moulding and core sands for the period 1977-1982 was estimated at 3,565,000 tons. The combined purchases of all the reporting foundries amounted to 2,583,250 tons or 72.5% of the total. On a regional basis, the percent response by consumption was:

Atlantic Region	20%
Quebec	78%
Ontario	72%
Prairies	74%
British Columbia	68%

The percent response by the type of foundry was:

Steel	61%
Iron	58%
Non-Ferrous	30%

3.2. Estimates of Sand Consumption

The 1982 and preceeding years were obtained by adding data obtained from suppliers to the questionnaire data. The suppliers provided estimates or actual records of sand purchases made by major foundries in their area who had not returned their questionnaires. In addition, the suppliers provided estimates of total sand consumption in their area. Notes and records from our files were used to supplement this data.

Regardless of brand name or supplier, the silica sands have been grouped by origin, since there are only minor differences between sands mined by different companies from the same or similar deposits. It should be noted that "Ottawa" refers to sands from the St. Peter Sandstone formation mined in the area around Ottawa, Ill. and not necessarily to products sold by the Ottawa Silica Company.

This analysis has been done on a regional basis as well as a national total, since freight costs can be a major determining factor. Local sand in each case refers to material originating in that market area. These deposits are covered in more detail under a separate heading.

Projections for 1983 to 1992 were based on the questionnaire data, as well as the estimates for 1982 and previous years. Finally, the projected amounts were adjusted on the basis of changes in technology and in the marketplace.

The results are shown in Tables 1, 2 and 3.

TABLE 1 AVERAGE ANNUAL CONSUMPTION OF MOULDING AND CORE SANDS - BY REGION AND TYPE OF FOUNDRY

REGION	TYPE OF FOUNDRY	AVERAGE ANNUAL CONSUMPTION (TONS)		
		1977-1981	1982	1983-1992
Atlantic	*Steel)	5,000	3,500	4,200
	Iron)			
	Non-Ferrous	1,000	500	800
	Sub-Total	6,000	4,000	5,000
Quebec	Steel	32,000	20,000	26,000
	Iron	63,000	48,000	58,000
	Non-Ferrous	10,000	6,000	8,000
	Sub-Total	105,000	74,000	92,000
Ontario	Steel	60,000	42,000	52,000
	Iron	480,000	298,000	344,000
	Non-Ferrous	15,000	10,000	12,000
	Sub-Total	555,000	350,000	408,000
Prairies	Steel	15,000	12,000	16,000
	Iron	13,500	11,500	18,200
	Non-Ferrous	500	500	800
	Sub-Total	29,000	24,000	35,000
British Columbia	Steel	12,000	11,000	12,500
	Iron	5,400	4,000	6,000
	Non-Ferrous	600	500	500
	Sub-Total	18,000	15,500	19,000
	Grand Total	713,000	467,500	559,000
	Total Steel	119,000	85,000	106,500
	**Iron	566,000	365,000	430,400
	Non-Ferrous	27,100	17,500	22,100

* Combined because there is only one steel foundry in the Atlantic Region.

**Includes steel foundry consumption in the Atlantic Region.

TABLE 2 AVERAGE ANNUAL CONSUMPTION OF MOLDING AND CORE SANDS - BY REGION AND MAJOR TYPES OF SAND

REGION	TYPE OF SAND	AVERAGE ANNUAL CONSUMPTION (TONS)		
		1977-1981	1982	1983-1992
Atlantic	Ottawa District	3,500	2,500	3,500
	Albany	500	500	500
	Local	2,000	1,000	1,500
Quebec	Ottawa District	70,000	45,000	53,000
	Olivine	10,000	8,000	16,000
	Local	20,000	12,000	14,000
	Other	5,000	9,000	9,000
Ontario	Ottawa District	80,000	50,000	54,000
	Portage	8,000	5,500	7,000
	Lake	350,000	265,000	312,000
	Bank	110,000	25,500	27,000
	Local	2,000	1,000	2,000
	Other	5,000	3,000	6,000
Prairies	Local*	26,500	22,500	34,000
	Other	1,500	1,500	2,000
British Columbia	Ottawa District	10,000	9,000	10,000
	Portage	2,000	1,000	1,300
	Olivine	5,500	5,000	7,000
	Other	500	500	700

* This is mainly Selkirk Sand.

TABLE 3 AVERAGE ANNUAL CONSUMPTION OF ALL MOULDING AND
CORE SANDS BY CANADIAN FOUNDRIES

SAND TYPE	AVERAGE ANNUAL CONSUMPTION (TONS)		
	1977-1981	1982	1983-1992
<u>Silica Sands</u>			
Ottawa District	163,500	106,500	120,500
Portage	10,000	6,500	8,300
Lake	350,000	265,000	312,000
Bank	110,500	28,400	27,000
Albany	600	500	600
New Jersey	500	500	600
McConnellsville	700	600	700
Local (Domestic)	50,500	36,500	50,500
<u>Non-Silica Sands</u>			
Olivine	16,000	14,000	25,000
Chromite	8,000	7,000	10,300
Zircon	2,700	2,000	3,500

3.3. Factors Affecting Future Consumption

The questionnaire asked the foundries to note major factors affecting future consumption of moulding and core sands. The estimates of consumption for the period 1983-1992 showed some increase over 1982, but in the regions other than the Prairies and British Columbia, the 1983-1992 projections were lower than the 1977-1981 consumption. Three major reasons were given:

(a) The conviction that the automotive market would not come back to its previous level. This would also depress the markets for foundries serving the iron ore and other mining industries.

(b) The move to reclamation of used sand. This was noted by seven foundries.

(c) Increased efforts to use sand more efficiently and thus reduce consumption.

4. MOULDING AND CORE SANDS USED BY CANADIAN FOUNDRIES

4.1. Silica Sands

4.1.1. Ottawa Silica

This material is mined from the St. Peter Sandstone formation which underlies much of the central part of the United States. It is mined only in a few locations where it appears close to the surface. The most important of these locations is in the vicinity of Ottawa, Ill. in LaSalle County. Although there is an Ottawa Silica Co., "Ottawa Silica" has become a generic term used to describe all the sands mined in the area, regardless of the source.

Ottawa Silica sand sets the quality standard by which other sands are compared. Typically, it contains less than 0.3% impurities after washing and drying. The grains are strong and round, except in the finer sizes, which tend to be subangular. The crude material ranges from an AFS No. of about 30 down to a fineness of 80-90. After washing and drying, the material is blended to produce a wide variety of grain finenesses.

As shown in Table 2, Ottawa sand is used throughout Canada and in all types of foundries.

4.1.2. Portage Sand (Wisconsin)

This material comes from the vicinity of Portage, Wisconsin, although similar sands are mined in other areas of the state. These sands are similar to Ottawa Silica in grain fineness and shape, but contain slightly more impurities (about 0.5%). In geological terms, they are bank sands, but are not usually referred to by that term.

Portage sand is used interchangeably with Ottawa Silica in all but the most severe applications.

Note: References 2,3,4 and 5 were consulted for this section.

4.1.3. Lake Sand

Most of the lake or dune sand comes from Michigan and Indiana. It is mined from dunes or dredged from the lakeshores. Most of this material tends to be sub-angular and commonly ranges from AFS 45 to 55. Silica contents generally range from 93% to 96%.

The lower purity, and consequently lower sintering point restricts its use to iron and non-ferrous foundries. Because other properties are excellent and transportation costs are low lake sand is widely used in the foundries of Southern Ontario. As shown in Tables 2 and 3, this material accounts for more than half of the moulding and core sand consumed in Canada.

4.1.4. Bank Sand

Most of the bank sand used in Canada comes from Michigan. These sands are similar in origin to the lake sand, but contain more impurities - mainly clays. They are also finer-ranging from AFS 60 to 160, with a 3 to 4 screen distribution. Bank sand is mainly used for light castings or where a fine finish is required. In the latter case, it may be used as the system sand or as a facing.

4.1.5. Other Silica Sands

Albany sand comes from New York and is a naturally bonded material. It is still used in a few non-ferrous foundries. The consumption of naturally bonded sand is gradually declining as foundries move to the "synthetic" practice, in order to take advantage of modern foundry processes and equipment.

New Jersey sand is used by a few foundries in Quebec and Ontario. It is of high quality and can be used in all but the most severe applications.

McConnellsville sand comes from Oneida County in New York. There is a considerable range in silica content. Generally its application is restricted to medium and light iron castings.

4.1.6. Domestic Silica Sands

There are eight active domestic suppliers of moulding and core sands. The Selkirk Silica Division of Steel Brothers Canada Ltd. produce a high quality (99.6% SiO_2) round grain sand from a deposit at Black Island in Lake Winnipeg. They supply most of the foundry industry in the Prairie Region. However, the cost of their sand is such that it does not offer sufficient economic advantage to supplant the established materials in Vancouver.

All of the other domestic producers are limited to local markets. Due to either lack of processing or the inherent properties of the sand, some of these products are very low grade. They gain local acceptance due to their low cost where a nearby foundry can adjust their processes or compromise the as-cast quality of their products.

Adequate technical data were not available to assess the quality of some of the local supplies. However, it is known that Montreal Silica's product is comparable to the lake sands used so extensively in Ontario iron foundries. The Sil-Silica sand produced in the Edmonton area is also comparable to the lake sands.

Other domestic sources are located in or near:

Shubenacadie, Nova Scotia
Trois-Rivières, Québec
Plessisville, Québec
Pont Rouge, Québec
Bracebridge, Ontario

4.2. Non-Silica Sands

4.2.1. Olivine

Olivine is a continuous solid solution of forsterite, a magnesium silicate, and fayalite-an iron silicate. Its physical properties vary with its chemical composition, which varies from deposit to deposit. The major characteristics of olivine are:

(a) Basicity - this is an advantage or a necessity in casting manganese steel.

(b) High thermal properties - both thermal conductivity and thermal capacity are higher than silica sand. This is an advantage in casting heavy sections.

(c) Low expansion coefficient - this reduces some casting defects.

(d) Low free silica - this reduces health hazards in the foundry.

(e) High bulk density

(f) High durability

Olivine is used in all foundries producing manganese steel and has in recent years come into increasing use in aluminum foundries.

The olivine sand used in Canadian foundries comes from either Washington State or North Carolina. This material is usually used where it is either essential for quality reasons, or where the savings obtained as a result of its special properties warrant the additional cost. However, olivine is used by most iron foundries in British Columbia simply because it is cheaper to bring it in from Washington than silica sand from Illinois, Michigan or Wisconsin. The basicity of olivine is a disadvantage in using organic chemical binder systems, but this has not been a major deterrent in British Columbia.

It is generally expected that the consumption of olivine will increase despite the overall decrease expected for the foundry sand market.

4.2.2. Chromite

Chromite ores are solid solutions of iron, chromium, magnesium and aluminum oxides. Although there are many chromite deposits in North America, most of them are low in chromium oxide. The chromite used in the foundry industry comes from South Africa and Rhodesia.

Chromite's use as a specialty sand derives from the following properties:

- (a) Thermal stability
- (b) High thermal conductivity and capacity
- (c) It is not easily wetted by molten metal
- (d) Low chemical reactivity

Their relatively low coefficient of expansion, angular grains and slight basicity are limiting factors.

The major application of chromite is in steel foundries.

4.2.3. Zircon

Zircon sand is primarily zirconium silicate. The major advantages it offers are:

- (a) Low thermal expansion
- (b) High thermal conductivity and capacity
(4 times the cooling rate of silica sand)
- (c) Unwetted by molten metal
- (d) Completely unreactive

- (e) Round grains
- (f) Dimensional and thermal stability
- (g) Neutral or slightly acidic

Zircon sand is mainly used in steel foundries because of its excellent chilling properties. Generally, this material is used to cope with problem areas in heavy sections or in special washes and facings.

5. COST FACTORS

5.1. TECHNOLOGICAL CONSIDERATIONS

5.1.1. Green Sand Systems

In green sand systems, new sand enters the system as cores, facing sand or as regular additions. The amount of new sand required depends on the losses in the system (dust, drag-out, etc.) and the build up of burned-out or dead clay. In most systems, the process losses are not sufficient and periodically an amount of sand is intentionally withdrawn. Generally, the amount of new sand entering via the cores and/or facing will vary with the product mix and the direct addition of new sand will be adjusted accordingly.

Since the direct addition is in effect a quality control adjustment, it may vary not only in amount, but also in grain size or screen distribution. Thus, the type and amount of new sand purchased is seldom consistent except in a few special purpose foundries producing long runs of identical products.

5.1.2. Chemical Binder Systems

The sand losses in chemical binder systems range from 100% where there is no reclamation to 10% where there is efficient reclamation. Because the binders are expensive, most foundries with sand reclamation will tend to use high quality sands which will require the lowest binder additions. Quality in this case would be measured by purity (either low clay content or low acid demand) and by grain shape (round grains require less binder per unit weight or volume).

Foundries without reclamation are in a dilemma. They must find a solution to the question whether they use less binder and discard a more expensive sand, or use more binder and discard a less expensive sand. The latter alternative is the usual approach.

5.1.3. Quality

Regardless of the type of sand system, a foundry must produce an acceptable level of quality at an economic price. Quality is a cost which must be incurred in every foundry. In the past, the price of quality was paid by using a large number of highly skilled craftsmen. This approach is rarely feasible today, where only a highly mechanized or automated operation can survive even if the craftsmen were still available.

In modern foundries, the quality cost is paid for by an investment in quality control facilities and people, or by restricting the operation to the use of the most expensive materials available. Usually a refusal to try new or more economic materials or methods can be traced more readily to a lack of quality control than to a high regard for quality.

Over and above these general conditions, the quality/price trade-off in sand practice is reduced to deciding whether to pay for higher quality in the moulding area or in the cleaning department. Intermediate solutions such as the use of special facing sands are also available.

5.2. Purchasing Practices

Most of the moulding and core sand used in Canada is purchased from foundry supply houses or regional sales offices of the American producers. The foundry supply houses may purchase directly from the supplier and resell the sand to the foundry. This is usually the method used to supply smaller foundries who do not have the need, or perhaps the facilities to receive carloads or boat-loads of sand. The reselling approach is also in effect when the supply house does some processing or packaging for the foundry. In these cases, the cost of the sand to the supplier is confidential.

Larger foundries may buy sand in carloads or even boat-loads in which case the supply house or sales office acts only as a broker or agent, and the actual cost of the sand at the producers plant or mine is known.

Some very large foundries purchase raw sand directly from the source and do their own washing, drying and screening.

In essence the purchasing practice varies with the size of the foundry and their handling and processing facilities.

5.3. Sand Cost

The cost of the sand itself (at the mine or processing plant) depends on the mining and processing costs. Any one sand will usually have a range of prices depending on the fineness specified and the need for special blending - for example, to produce a four screen sand.

5.4. Transportation Cost

As with any other bulk commodity, the cost of transporting sand is a function of distance and mode of transport. Water transport of large tonnages is the cheapest method. Truck transportation of bagged sand is the most expensive. Many foundries have found it advantageous to invest in storage and

handling facilities in order to reduce their transportation costs. This trend has also impelled many foundries to rationalize their sand practice. They have adjusted their practices to reduce the number of different types of sand they used.

Such changes have been made by a large number of foundries over the past few years. Thus, an average annual expenditure for sand would be of doubtful significance.

Regardless of routing, transportation costs are paid in Canadian funds. Since the routing and hence port-of-entry may change from one shipment to the next, the U.S. portion of the transportation costs cannot be identified.

5.5. Cost Trends

The two major cost components are material and transportation. During the last 20 years, the cost of transportation has escalated far more rapidly than the cost of the sand. For example, typical costs for a Hamilton foundry in 1962 were \$3/ton for sand and \$6 for freight. In 1982, the same material cost \$7 and freight charges are \$33.

Some typical current costs are shown in Table 4.

Table 4 Some Typical Current Costs of Moulding and Core Sands - 1982

SOURCE	*SAND COST/TON (CDN. \$)	DESTINATION	TRANSPORT MODE	*TRANSPORT COST/TON (CDN. \$)	*TOTAL COST (CDN. \$)
Ottawa District	\$12	Montreal Hamilton Kitchener Vancouver	100 ton rail cars	\$40 \$36 \$50 \$78	\$52 \$48 \$62 \$90
Lake Sand Hamilton Plant	\$18 (at Hamilton)	Hamilton St. Thomas	Boat to Hamilton and truck to foundry	\$ 4 \$ 7	\$22 \$25
Portage District Wisconsin	\$12	Vancouver	rail car	\$70	\$82
Selkirk	\$31	Saskatoon	40 ton rail cars	\$46	\$77
Vassar, Michigan	\$15	Brantford	100 ton rail cars	\$22	\$37

* Rounded off to nearest dollar.

6.

TRADE IN SILICA SAND

Table 5 summarizes the import data for silica sand for the years 1977-1982. In comparing the data for foundry sand, one must note that this covers all sand destined for foundries. Thus, material used for cleaning, refracteries or fluxes is included. It should also be noted that imports which are not specifically destined for foundry use are included in the NES category. This last item includes substantial tonnages of raw sand some of which may have been processed in Canada for moulding and core making purposes.

No trade data are available for olivine, chromite or zircon sands.

The average value of imported moulding sand increased as follows:

1977	\$6.26/ton
1978	\$8.76/ton
1979	\$8.72/ton
1980	\$10.93/ton
1981	\$11.75/ton
1982	\$12.97/ton

According to Statistics Canada, the average of silica sand imports for the five years - 1977 to 1981 was 624,645 tons as compared to 635,800 developed in this survey. Foundries account for a major portion of silica sand imports. The percentage of total silica sand imports destined for the foundry industry was:

1977	50.0% of total silica sand imports
1978	47.7%
1979	44.0%
1980	34.8%
1981	30.6%
1982	28.6% (8 months)

As can be seen there has been a general downward trend since 1977.

The production of silica sand in Canada is combined with quartz. However, it is safe to assume that moulding and core sand cannot account for more than a minor portion of the total.

Table 5 TRADE IN SILICA SAND

YEAR	FOUNDRIES	GLASS INDUSTRY	NES	TOTAL
<u>1977</u> Tons \$	607,437 \$ 3,804,000	281,154 \$1,964,000	325,259 \$3,758,000	1,213,850 \$9,526,000
<u>1978</u> Tons \$	653,175 \$ 5,724,000	393,048 \$3,470,000	323,337 \$4,292,000	1,369,560 \$13,486,000
<u>1979</u> Tons \$	800,514 \$ 6,983,000	585,594 \$6,146,000	434,834 \$6,265,000	1,820,942 \$19,394,000
<u>1980</u> Tons \$	542,347 \$ 5,926,000	395,499 \$5,212,000	618,665 \$3,024,000	1,556,511 \$13,162,000
<u>1981</u> Tons \$	519,750 \$ 6,105,000	391,409 \$4,914,000	786,294 \$4,163,000	1,697,453 \$15,182,000
<u>1982</u> Tons \$ To Sept.1	227,692 \$ 2,954,000	225,168 \$3,006,000	136,738 \$4,371,000	1,697,453 \$10,331,000

Source: Statistics Canada

7. DISCUSSION

7.1. Economic Factors

Current economic conditions affected this study in several ways. Many of the foundries to whom questionnaires were sent were shut down temporarily or permanently. There was a net decrease of 28 in the number of active sand-casting foundries or about 9% since our 1978 study (1). When this survey started in August, the foundry industry was operating at about 40% to 50% of its tonnage capacity. This decreased by about another 10% to 15% when our field work was completed at the end of October.

Obviously, the severely depressed economy and uncertainty about the future tended to colour estimates of sand consumption for 1982 and beyond. Most foundries used purchasing records as the basis for sand consumption since very few make accurate measurements of actual sand consumed or lost in their processes. Thus 1982 estimates were made up of 1982 actual purchases to date, and purchases expected over the balance of the year. Since economic activity decreased sharply during the third quarter, much of the sand that foundries planned to buy in 1982 will not be bought until 1983.

The terms of reference for this project stipulate that the time dimension be partitioned into three components; 1977 to 1981, 1982 and 1983 to 1992. In actual fact, a year-by-year analysis would show a steady increase in sand consumption from 1977 to 1979, followed by decreases of about 25% in 1980, a further 5% in 1981 and probably another 20% in 1982. The consumption of moulding and core sands in 1982 will probably be about half the amount consumed in 1979.

In the Prairie Region and British Columbia, the steady climb continued through 1981 with a very sharp drop in 1982 of about 50% from 1981. There are signs that this part of the industry may recover faster than in the rest of Canada.

In any case, sand purchases will certainly lag behind foundry activity as inventories of sand are drawn down.

The general consensus among foundry managers and suppliers was that the total foundry activity in Canada will not regain its former level in the foreseeable future. The major reasons are:

(a) The North American automobile and agricultural machinery industries will not fully regain their former dominant positions.

(b) Automobiles and agricultural machinery castings will be smaller and lighter.

(c) There are no megaprojects either active or anticipated. This has a major effect on the sale of construction equipment, which has a significant castings requirement.

(d) The deficit of railway rolling stock was more than overcome during the late 1970's.

On a regional basis, the foundry industry in the Prairies and British Columbia is not as exposed to these major negative economic factors and the growth rate should be higher from 1983 onwards. This is reflected in the projections of sand consumption.

As a result of the rapid escalation of transportation charges, foundries have become much more concerned with the total cost of sand landed at their plants. Seeking out cheaper grades of material offers little in real savings. The more effective approach is to find ways to reduce total transportation and handling costs. This can be done by using local sands or by developing the facilities to handle larger shipments. For example, a foundry with adequate silo capacity can receive bulk shipments rather than bags or pallets. The provision of adequate

storage and either rail or dock facilities with proper handling equipment, could allow them to receive rail car or even boat shipments. Any one of these measures can introduce significant savings now, and even greater savings in the future.

Another worthwhile approach is to use less sand per ton of castings produced. This is accomplished by changing to more durable sands, (ex. aluminum foundries changing from silica to olivine) using a lower sand to metal ratio in designing patterns and flasks, and also in improving the reclamation of used sands.

The increasing cost of dumping used sand while meeting environmental standards is an additional incentive to reducing the amount of sand consumed.

The above conditions and trends will accelerate the rationalization of the foundry industry, i.e. fewer and larger foundries. The need to decrease transportation costs will also encourage foundries to simplify their sand practice. In order to purchase sands in larger amounts and provide storage facilities, foundries will have to decrease the variety of sand types they purchase and adapt their processes accordingly.

7.2. Technological Factors

The major technological factors affecting sand practice and consumption are:

The need to consume less sand as noted in the previous section is leading to increased sand reclamation, lower sand to metal ratios in both green sand and air-set operations, and also improved sand handling equipment to decrease dust and spillage.

(a) The trend to using chemical binders in order to gain cost and quality advantages will continue. This has the effect of increasing the demand for higher quality sands and reducing overall sand consumption - if there is sand reclamation.

(b) The need to rationalize sand practices will require better process control and equipment.

(c) The trend to thinner castings and better surfaces will lead to the use of finer grain sizes as well as better process control.

(d) There is an increasing awareness of the importance of controlling the costs of cleaning and repairing castings. This factor plus the more stringent quality demands of their customers will tend to favour those foundries who use higher quality sands and exercise better process control.

The above factors in conjunction with the need to reduce transportation costs will increase the incentive for the development, expansion or upgrading of Canadian sources of supply in specific areas.

As noted in Section 6 of this report, moulding and core sand represents about 40% of the total silica sand imported by Canada and an almost insignificant proportion of the domestic silica production. Within the general context of national economics, the substitution of imports by domestic sources should be an imperative. However, when one considers the high transportation costs paid by many Canadian foundries, there is an added impetus for the development of Canadian supplies.

In terms of opportunities, the only possibilities for a potential Canadian supplier in the Southern Ontario market would be:

(a) Sand of equivalent quality to that of the Ottawa District material which can be transported to Southern Ontario and sold competitively.

(b) Sand of equivalent or similar quality to lake sand that can be mined in Southern Ontario or brought by boat to Hamilton.

In both cases, mining and processing costs would have to be competitive.

None of the existing Canadian suppliers could meet the combination of these requirements. The only possibility is a proposed operation at Magdalen Island (La Silice Magdalen Inc) which could use the St. Lawrence Seaway and boat transport to land sand in Hamilton, Toronto, Montreal or Halifax.

The Prairie Region is well served by Selkirk Silica and to a lesser extent by Sil-Silica of Edmonton.

In British Columbia, foundries use mainly Ottawa or Wisconsin silica sands and olivine from Washington. Some

of the iron foundries use olivine primarily because its cost landed at the foundry is significantly lower than the Ottawa or Wisconsin material.

The cost of Selkirk silica at the processing plant is much higher than equivalent U.S. sands and consequently, after transportation costs have been paid, there is little incentive to use this material in the Vancouver area.

Ottawa District silica	-	Vancouver	\$89.00
Wisconsin silica	-	Vancouver	\$82.50
Selkirk silica	-	Vancouver	\$90.00(approx.)

There is an opportunity for sands in Quebec which can be competitive in total cost (material and transport) as well as in quality with both Ottawa District and lake sands. This need could be satisfied by the Magdalen Island operation and/or by upgrading existing operations.

The non-silica sands represent interesting opportunities. Although no zirconite deposits have been reported in Canada, there are significant deposits of both chromite and olivine.

The annual consumption of olivine in Canada is expected to reach 25,000 tons. In fact, this material is the only major sand which is expected to exceed its pre-1982 sales. There is little doubt there could be more growth in tonnage and dollar sales, if the cost was reduced. Foundries in Western Canada obtain olivine from Washington State. The foundries in Central and Eastern Canada are supplied from mines in North Carolina. There is a very substantial deposit of olivine in Quebec ⁽⁶⁾ which could not only supplant the material from North Carolina in the Canadian market, but could also compete in the Eastern U.S. market. In addition to this deposit, efforts are underway to develop the waste material from asbestos mining to produce an olivine sand.

Most of the chromite used in North American foundries comes from South Africa and Rhodesia. Deposits of suitable material are known to exist in Manitoba and Newfoundland. Obviously, the foundry sand market would not justify their development, but there are even more significant markets for ferrochromium in the steel and foundry industries.

Since Canadian foundry markets outside of Southern Ontario are small and scattered, viable silica sand production should include sands used for other purposes. The most likely of these are glass sand and fracturation sand.

Glass sand specifications require a high degree of purity (99% SiO_2). Grain size requirements are similar to those of foundry sands.

Fracturation sand also requires high purity to ensure chemical inertness in fracturing and reservoir fluids. Grains should be round in shape and have a high compressive strength. A uniform grain size is preferred in the 20 to 40 mesh size, which is somewhat coarser than most foundry sands.

Both of these materials are compatible with a foundry sand operation and are also imported in large quantities from the United States.

Both olivine and chromite have uses other than as foundry sand. Olivine is used in the refractory industry and chromium as ferrochromium has extensive use in the production of stainless and other alloy steels as well as the alloy cast irons used extensively in mining chemical processing and construction equipment.

No published or official specifications are in common use for moulding and core sands. Some of the larger foundries have developed internal specifications based on physical and chemical properties, but these are limited to their own operations.

The most common practice is to select a sand according to a known standard (ex. Ottawa, Juniata, etc.) The AFS Finess No. is specified as well as the screen distribution. Sands are usually either 3-screen or 4-screen; meaning that most of the material is retained on either 3 or 4 consecutive screens. Foundries using organic chemical binders will also be concerned with the basicity or "acid-demand value" of the sand.

Other important characteristics such as grain shape and grain strength tend to remain consistent within any one deposit.

Over and above all of these requirements is the actual performance in any particular foundry. This is affected by the product mix , the moulding and core making methods and the equipment used.



7.5. Security of Supply

According to officials of a major U.S. sand supplier, there are adequate reserves of all major U.S. sources for many years to come. The same holds true for existing silica sand producers in the Prairie Region, where there are extensive deposits in all three provinces, which still have not been developed.

Environmental groups and conservationists in some parts of the United States have protested sand mining operations on lake shores and in dune areas. However, this pressure does not appear to pose a threat to any of the established producers. The current political climate in that country, plus the efforts of most mining companies to preserve or restore the environment have effectively defused any attempts to curtail operations.

Municipal encroachment poses a problem in some sand-producing areas in California and New England, but is not expected to affect the major sources of supply used by Canadian foundries.

The mining and processing of silica sand does pose a health problem to the workers and the nearby population. However, this can be controlled with dust collection equipment and protective masks.

Transportation routes and methods are well established. There is little likelihood of any problem which could threaten supplies to Canadian foundries.

8. RECOMMENDATIONS

The following recommendations are based on not only preserving the economic health of the Canadian foundry industry, but also to allow it to become more competitive with U.S. foundries. This will help to increase foundry exports and also help Canadian casting buyers compete more effectively in both foreign and domestic markets.

8.1. In most cases, local or domestic sand provides a saving to the foundry. However, the cost of the sand itself is usually much greater than the American material, thus eliminating most of the savings in transportation costs. Efforts should be made to assist these suppliers in reducing the cost of their products.

It should be noted that if these suppliers are pricing on a competitive basis - that is, setting their price in accordance to the laid-down costs of imported sands, they are in fact restricting the growth of their customers. In the long run, this will have a negative effect on their own growth.

If the cost of domestic sands can be reduced, their respective market areas could be greatly enlarged. For example, if the price of Selkirk silica could be brought down to a level 50% over Ottawa District sand, it would be attractive to British Columbia foundries and their total sales to Western Canadian foundries could be doubled.

8.2. The feasibility of upgrading existing Canadian sources should be studied. **There** are suppliers who now sell unprocessed or partially processed sand to limited markets.

8.3. Feasibility studies should be undertaken to develop silica sand deposits on or near the St. Lawrence Seaway. The combination of low cost water transportation and high quality (Ottawa District equivalent) could be a major advantage to foundries in Quebec, Ontario and the Atlantic Region.

8.4. Assistance should be provided to Canadian foundries who wish to reduce their sand costs by improving their handling and storage facilities. Such projects should have a high priority in the system of programs sponsored by Industry, Trade & Commerce.

8.5. A high priority should be given to developing commercial sources of olivine in Canada, either from the Quebec deposit or the asbestos by-product. In either case, U.S. markets should be considered.

8.6. The feasibility of developing chromite deposits in Manitoba and/or Newfoundland should be studied to reduce our dependence on South African and Rhodesian sources.

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10. REFERENCES

1. R.C. Shnay, "Study and Assessment of the Technological Capabilities of the Canadian Foundry Industry", Department of Energy, Mines and Resources - Contract No. OSQ78-00079 (1978).
2. "Moulding Methods and Materials", American Foundrymen's Society, (1962).
3. "Foundry Core Practice", American Foundrymen's Society, 2nd Edition (1952).
4. Clyde A. Sanders, "Foundry Sand Practice", American Colloid Company, 6th Edition (1973).
5. T.E. Garner, Jr., "Mineralogy of Foundry Sands and its Effect on Performance and Properties", Transactions of the American Foundrymen's Society, Vol. 85 (1977) pp. 399-416.
6. National Mineral Inventory, Ref. OLV1, Industrial Minerals Branch, Mineral Policy, Sector, Energy, Mines and Resources Canada.

ATLANTIC REGIONSteel Foundries

Maritime Steel and Foundries Ltd.,
379 Glasgow Street,
New Glasgow, N.S.
B2H 5C3

Iron Foundries

Angel Manufacturing & Supply Co. Ltd.,
King Street,
North Sydney, N.S.
B2A 3M1

Breton Foundry,
P.O. Box 1330,
Sydney, N.S.
B1P 6K3

St. John Foundry Ltd.,
P.O. Box 2025,
St. John, N.B.
E2L 3T5

The Enterprise Foundry Co. Ltd.,
Sackville, N.B.
EOA 3C0

Hall & Stavert Ltd.,
49 Pownal Street,
Charlottetown, P.E.I.

Industrial Marine Products Ltd.,
P.O. Box 535,
Dartmouth, N.S.
B2Y 3Y8

Lunenburg Foundry & Engineering Ltd.,
P.O. Box 1240,
Lunenburg, N.S.
BOJ 2C0

New Glasgow Foundry Ltd.,
391 Glasgow Street,
New Glasgow, N.S.

Steel & Engine Products Ltd.,
P.O. Box 1120,
Liverpool, N.S.
BOT 1K0

Amherst Foundry Co.,
10 Highfield Street,
Amherst, N.S.
B4H 1G4

Non-Ferrous Foundries

Abco-Acadia Ltd.,
Bridgewater, N.S.

Canadian National Railway,
John Street,
Moncton, N.B.

Four D Enterprises Ltd.,
P.O. Box 313,
Moncton, N.B.

Lauder Mfg. Ltd.,
P.O. Box 128,
Hillsboro, N.B.

QUEBEC

Steel Foundries

Abex Industries,
620 Rue Laval,
Joliette, Québec

Canadian Steel Foundries Div.,
Hawker Siddeley Canada Ltd.,
P.O. Box 80, Station M,
Montreal, Québec

Dominion Engineering Works Ltd.,
P.O. Box 220,
Montreal, Québec
H3C 2S5

Griffin Steel Foundries Ltd.,
P.O. Box 310,
St. Hyacinthe, Québec
J2S 7B6

Acier Sorel Ltée.,
160 rue du Roi,
Sorel, Québec

Unitcast Div.,
Midland-Ross of Canada Ltd.,
455 rue Belvedere Sud,
Sherbrooke, Québec
J1H 5K2

Metallurgie Frontenac Ltée.,
C.P. 249,
Thetford Mines, Québec
G6G 5S9

Iron Foundries

Antique de Daveluyville Ltée.,
414 - 3ième Ave.,
Daveluyville,
Cté Arthabaska, Québec

Canron, Inc. (*D.I. Pipe Only)
227 rue St. Maurice,
Trois-Rivières, Québec

Darling Duro Ltd.,
140 rue Prince,
Montreal, Québec
H3C 2N2

Elgin Iron Works, Reg.,
R.R.2, Athelstan,
Cté Huntingdon, Québec
JOS 1A0

Fonderie Belgen, Inc.,
4475 Blvd. St. Joseph,
Drummondville, Québec

Fonderie Canadienne, Enr.,
374 rue St. Jacques,
St. Jean, Québec
J3B 2L6

Fonderie Emery Cormier,
62 Rang S. Charles,
Joliette, Québec

Fonderie Grand'Mère Ltée.,
C.P. 336,
Grand'Mère, Québec
G9T 5L1

La Fonderie Laperle Ltée.,
C.P. 148,
St. Ours, Québec
JOG 1P0

Fonderie Z. Laroche & Frères Ltée.,
C.P. 69,
Pont-Rouge, Québec
JOA 2X0

La Fonderie de Lauzon Ltée.,
50 rue Normandin,
Lauzon, Québec
G6V 3J7

Fonderie Napierville Ltée.,
C.P. 40,
Napierville, Québec
JOJ 1L0

Fonderie Nova Inc.,
C.P. 37,
St. Hyacinthe, Québec

La Fonderie Ouellet, Inc.,
C.P. 118,
St. Léonard d'Aston,
Cté Nicolet, Québec
JOC 1M0

Fonderie Ste. Anselme,
1 rue de la Fonderie,
Ste. Anselme, Québec
GoR 2N0

Fonderie Ste. Croix,
C.P. 68, Ste. Croix,
Cté Lotbinière, Québec
GOS 2H0

Fonderie de Thetford (1969) Inc.,
C.P. 85,
Thetford Mines, Québec
G6G 5R9

Fonderie Waterloo, Inc.,
Rue Allen,
Waterloo, Québec
JOE 2N0

Fontac, Inc.,
8850 Blvd. Parent,
Trois-Rivières, Québec
G9A 5E1

Forano Ltée.,
1600 rue St. Paul,
Plessisvilles, Québec
G6L 2Y9

Jenkins Bros. Ltd.,
170 St. Joseph Blvd.,
Lachine, Québec
H8S 2L6

Metallurgie Karby, Enr.,
1099 Rang du Sud,
St. Pierre,
Cté Montmagny, Québec
G03 4B0

Mueller Industries Ltd.,
2360 rue Castonguay O.,
St. Jerome, Québec

Norcast Ltd.,
Mont Joli,
Québec

Pierre Thibault, Ltée.,
C.P. 210, Pierreville,
Cté Yamaska, Québec
JOG 1J0

Jos. Poitras et Fils Ltée.,
C.P. 128,
L'Isletville, Québec
GOR 2C0

Les Produits de Chauffage J.L. Ltée.,
Daveluyville,
Cté Arthabaska, Québec

Stanton Foundry Ltd.,
5335 Ramsay,
St. Hubert, Québec`
J3Y 2S3

Maggoteaux Canada Ltée.,
C.P. 369,
Magog, Québec

Fonderie Fortin Ltée.,
R.R. 112,
Waterloo, Québec

Fonderie Saguenay Ltée.,
2001 Boul. Talbot,
Chicoutimi, Québec
G7H 5G4

Non-Ferrous Foundries

Alucast Inc.,
239 Blvd. Industriel,
St. Eustache, Québec
J7R 4K3

Aluminum Foundry and Pattern Works Ltd.,
1345 Miron Street,
Ville St. Laurent, Québec
H4N 2C9

Aubertin Foundries Ltd.,
10101 Herbert Street,
Montreal North, Québec
H1H 3W5

Canadian Stone Marine Ltd.,
420, 9e Avenue,
Iberville, Québec
J2X 1K3

Dorion & Frères, Inc.,
8945 rue Paris,
Montreal Nord, Québec

Duspal,
1970 Ch. du Chemail du Moine,
Ste.-Anne-de-Sorel, Québec

Lumec, Inc.,
618 Curé Boivin,
Boisbriand, Québec

Fonderie d'Art et d'Artisanat du Québec, Inc.,
5438 Henri-Bourassa,
Montreal, Québec
H1G 2S9

Fonderie Benoit Marcoux,
Rang 8,
Laurierville, Québec

Fonderie Cenal Ltée.,
C.P. 336,
St. Remi, Québec
JOL 2L0

Fonderie St.-Romuald, Inc.,
C.P. 2008,
St.-Romuald, Québec

G.T.E. Sylvania Canada
760 Notre Dame,
St. Remi, Québec

Fondrec, Inc.,
40 Blvd. des Laurentides,
St. Antoine des Laurentides, Québec
J7Z 5T4

Fondremy, Inc.,
2455 Blvd. Industriel,
Chambly, Québec

Gaulin Fonderie,
St. François,
Cté Montmagny, Québec

Luxor Industries, Inc.,
7941 Léonard de Vinci,
Ville St. Michel, Québec
H1Z 3R5

Mercier Foundries Ltd.,
2425 Ford Blvd.,
Chageauguay Centre, Québec
J6J 4Z2

Les Industries Cuthbrite Inc.,
47 Duke Street,
Montreal, Québec
H3C 2L9

Modern Aluminum Products Ltd.,
1525 rue Notre Dame O.,
Montreal, Québec
H3C 1L1

Pole-Lite, Inc.,
1, Blvd. Edouard VII,
St. Philippe,
Laprairie, Québec
JOL 2K0

Rapid Foundry,
302 Rang Double,
St. Urbain,
Cté Chateauguay, Québec
JOS 1Y0

The Robert Mitchell Co. Ltd.,
350 Décarie Blvd.,
Montreal, Québec
H4L 3K5

Sept-Iles Metalworks Inc.,
154 rue Maltais,
Sept-Iles, Québec

Union Screen Plate Co. Ltd.,
P.O. Box 790,
Lennoxville, Québec
JOB 1Z0

The following iron foundry also produces non-ferrous
castings:

Manville Canada Inc.,
1700 rue Centrale,
St. Hyacinthe, Québec

ONTARIO

Steel Foundries

Alloy Casting Industries Ltd.,
374 Hamilton Road,
New Hamburg, Ontario
NOB 2G0

Black Clawson - Kennedy,
Owen Sound, Ontario
N4K 5P9

C.S. Castings Ltd.,
P.O. Box 247,
Orillia, Ontario
L3V 6J6

Canada Alloy Castings Ltd.,
539 Manitou Drive,
Kitchener, Ontario
N2C 1S2

Dominion Foundries & Steel Ltd.,
P.O. Box 460,
Hamilton, Ontario
L8N 3J5

Dayton-Walther Co.,
355 Silvercreek Parkway,
Guelph, Ontario
N1H 1E6

Esco Ltd.,
P.O. Box 270,
Port Hope, Ontario
L1A 3W4

Fahramet Ltd.,
Wyandot Street,
Orillia, Ontario
L3V 2P6

Johnson, Mathey Ltd.,
Foundry Division,
P.O. Box 367,
St. Catherines, Ontario
L2V 3Z3

Magalloy Ltd.,
10 Pine Street,
Stratford, Ontario

Specialty Cast Metals Ltd.,
P.O. Box 2126,
Niagara Falls, Ontario
L2E 6Z2

Welmet Industries Ltd.,
P.O. Box 370,
Welland, Ontario
L3B 3K2

Iron Foundries

Algoma Steel Corp. Ltd.,
503 Queen Street,
Sault Ste. Marie, Ontario
P6A 2A2

Alloy Foundry Co. Ltd.,
P.O. Box 130,
Merrickville, Ontario
K0G 1N0

A.G. Anderson Ltd.,
P.O. Box 6006, Station D,
London, Ontario
N5V 2Y3

S.A. Armstrong Ltd., Casting Division,
20 Hanna Court,
Belleville, Ontario
K8N 5J1

Babcock & Wilcox Canada Ltd.,
Coronation Blvd.,
Cambridge, Ontario
N1R 5V3

Bell City Foundry Ltd.,
411 West Street,
Brantford, Ontario
N3R 3V9

Benn Iron Foundry Ltd.,
4 Mason Street,
Wallaceburg, Ontario
N8A 4M1

Bibby Foundry Ltd.,
P.O. Box 279,
Cambridge, Ontario
N1R 5T8

Bowmanville Foundry Co. Ltd.,
P.O. Box 69,
Bowmanville, Ontario
L1C 3K8

Brown Boggs Foundry and Machine Co. Ltd.,
P.O. Box 3004, Station B.,
Hamilton, Ontario
L8L 7Y2

Brown Foundry Ltd.,
P.O. Box 778,
Morrisburg, Ontario
K0C 1X0

Canada Valve Ltd.,
325 Grey Street,
Brantford, Ontario
N3T 5L5

Canadian Blower and Canada Pumps Ltd.,
90 Woodside Avenue,
Kitchener, Ontario
K2C 4K1

Canron, Inc.,
Foundry Division,
Wavi Iron Works,
New Liskeard, Ontario
P0J 1P0

Canron Inc.,
Foundry Division,
Alloy Foundry,
175 Stuart Street West,
Hamilton, Ontario
L8R 2W5

Canron Inc.,
Foundry Division,
Stool Foundry,
175 Stuart Street West,
Hamilton, Ontario
L8R 2W5

Canron, Inc.,
Foundry Division,
Ingot Mould Plant,
Burlington St. at Kenilworth,
Hamilton, Ontario
L8N 3C8

Canron Inc.,
Pipe Division,
324 Cherry Street,
Toronto, Ontario
M5A 3L2

Corbron Foundries Ltd.,
P.O. Box 1119,
Cornwall, Ontario
K6H 5R9

Crawford Machine & Foundry Ltd.,
P.O. Box 66,
Woodstock, Ontario
N4S 7W5

Crouse-Hinds Canada Ltd.,
1160 Birchmount Road,
Scarborough, Ontario
M1P 2B9

Crowe Foundry Ltd.,
P.O. Box 2009,
Cambridge, Ontario
N3C 2V6

Crowle Fittings Ltd.,
P.O. Box 254,
Malton Postal Station,
Mississauga, Ontario
L4I 3R6

Cunningham Foundries Ltd.,
21 Yale Crescent,
St. Catharines, Ontario
L2R 2Y6

Dart Foundries Ltd.,
P.O. Box 160,
Stevensville, Ontario
L0S 1S0

Date Industries Ltd.,
Swan Street,
Ayr, Ontario
N0B 1E0

Delhi Foundry and Machine Ltd.,
P.O. Box 880,
Delhi, Ontario
N4B 2W9

Domestic Foundries Ltd.,
1595 Crawford Avenue,
Windsor, Ontario
N8X 2A9

Dorr Oliver-Long Ltd.,
174 West Street South,
Orillia, Ontario
L3V 6L4

J.R. Ferguson Co. Ltd.,
P.O. Box 588,
Dundas, Ontario

Findlay Foundry Ltd.,
P.O. Box 250,
Carleton Place, Ontario
K0A 1T0

Ford Motor Co. of Canada Ltd.,
P.O. Box 8500,
Windsor, Ontario
N8Y 1W9

Galtaco, Inc.,
Otaco Division,
West Street South,
Orillia, Ontario
L3V 6L3

Galtaco, Inc.,
600 Kerr Street,
Cambridge, Ontario
N1R 5V8

Fittings (1980) Inc.,
135 Bruce Street,
Oshawa, Ontario

Galtaco, Inc.,
Brantford Foundry Division,
Powerline Road,
Brantford Township,
Ontario
N1R 5W1

General Motors of Canada Ltd.,
Foundry Division,
570 Glendale Avenue,
St. Catharines, Ontario
L2R 7B3

Georgian Bay Foundry Ltd.,
P.O. Box 360,
Meaford, Ontario
NOH 1Y0

Hamilton Foundry Co. Ltd.,
P.O. Box 335, Station B.,
Hamilton, Ontario
L8L 3J7

John T. Hepburn Ltd.,
914 Dupont Street,
Toronto, Ontario
M6H 1Z2

Holmes Foundry Ltd.,
P.O. Box 970,
Sarnia, Ontario
N7T 5M5

The Hopper Foundry (1977) Ltd.,
P.O. Box 29,
Forest, Ontario
NON 1J0

ITT-AIMCO Division,
ITT Industries of Canada Ltd.,
P.O. Box 1087,
St. Catherines, Ontario

H. Imbleau & Sons Ltd.,
11 Bridge Street North,
Renfrew, Ontario
K7V 3R1

International Malleable Iron Co. Ltd.,
P.O. Box 180,
Guelph, Ontario
N1H 6K1

Kanmet Ltd.,
P.O. Box 220,
Cambridge, Ontario
N3H 4J9

Kelsey-Hayes Canada Ltd.,
Woodstock Division,
P.O. Box 300,
Woodstock, Ontario
N4S 7X8

Massey Ferguson Industries Ltd.,
P.O. Box 370,
Brantford, Ontario
M6K 1E3

Lake Foundry & Machine Co. Ltd.,
287 South Service Road,
Grimsby, Ontario
L3M 1Y6

McCoy Foundry Ltd.,
R.R. #1,
Troy, Ontario
LOR 2A0

McLean Foundry Ltd.,
P.O. Box 1263,
Brantford, Ontario
N3T 5T3

Neelon Castings Ltd.,
P.O. Box 2007,
Station A.,
Sudbury, Ontario
P3A 4R7

Northern Ontario Castings Ltd.,
Entrance Drive,
Bracebridge, Ontario

Orangeville Foundry Ltd.,
R.R. #4,
Orangeville, Ontario
L9W 2Z1

Port Arthur Shipbuilding Ltd.,
P.O. Box 2690,
Postal Station D,
Thunder Bay, Ontario
P7B 5G2

Procast Foundries Ltd.,
P.O. Box 970,
Elmira, Ontario
N3B 2L6

Rockwell International of Canada Ltd.,
P.O. Box 848,
Guelph, Ontario
N1H 6M7

Standard Induction Castings Ltd.,
3827 Peter Street,
Windsor, Ontario
N9C 1K3

Stanton Pipes Ltd.,
P.O. Box 849,
Hamilton, Ontario
L8N 3N9

Stephens-Adamson Ltd.,
P.O. Box 5900,
Belleville, Ontario
K8N 5G8

Stittsville Foundry Ltd.,
340 Orville Street,
Stittsville, Ontario
K0A 3G0

Summerstown Metals Ltd.,
Summerstown, Ontario
K0C 2E0

Welland Iron & Brass Ltd.,
130 Niagara Street,
Welland, Ontario
L3C 1J3

Snowdon's General Castings Ltd.,
315 Grey Street,
Brantford, Ontario
N3T 5L5

Wells Foundry Ltd.,
1250 Florence Street,
London, Ontario
N5W 2N4

Western Foundry Co. Ltd.,
P.O. Box 460,
Wingham, Ontario
N0G 2W0

J.A. Wotherspoon & Sons Ltd.,
P.O. Box 400,
Oakville, Ontario
Oakville, Ontario
L6J 5A8

Woodside Machinist & Foundry Ltd.,
173 Manitou Street,
Thunder Bay, Ontario
P7G 1N9

Birla Industries Inc.,
P.O. Box 3400,
Windsor, Ontario
N8N 3C4

Non-Ferrous Foundries

Alumaloy Castines Ltd.,
483 Eastern Avenue,
Toronto, Ontario
M4M 1C2

Atkins & Hoyle Ltd.,
69-71 Portland Street,
Toronto, Ontario
M5V 2M9

Burnstein Castings Ltd.,
69 Catherine Street,
St. Catherines, Ontario
L2R 5E9

E.V. Burt Manufacturing Co.,
P.O. Box 88,
Black Diamond Road,
Belleville, Ontario
K8N 4Z9

Cambridge Brass Division,
Waltec Industries Ltd.,
471 Dundas Street,
Cambridge, Ontario
N1R 5T5

Chrysler Canada Ltd.,
(Etobicoke Casting Plant)
15 Brown's Line,
Toronto, Ontario

J. Coles Foundry Ltd.,
114 Sinnett Road,
Scarborough, Ontario
M1L 4M9

Crane Canada Ltd.,
P.O. Box 1355,
Brantford, Ontario
N3T 5T7

Custom Aluminum Foundry Ltd.,
P.O. Box 92,
Cambridge, Ontario
N3C 2V6

D.G.M. Foundry Ltd.,
P.O. Box 91,
11 Garfield Avenue,
London, Ontario
N6A 4B3

Dunbar Aluminum Foundry Ltd.,
315 Breithaupt Street,
Kitchener, Ontario
N2H 5H6

Emco Ltd.,
P.O. Box 5300, Terminal A,
1108 Dundas Street East,
London, Ontario
N6A 4N7

Encast,
Division of Nordic Steel Products Ltd.,
1044 Rangeview Road,
Mississauga, Ontario
L5E 1H3

Eramosa Brass & Aluminum Ltd.,
P.O. Box 180,
120 Dawson Road,
Guelph, Ontario
N1H 1A6

Fairbank Foundry Co.,
52 Clarkson Street,
Toronto, Ontario
M6E 2T6

Fisher & Son Ltd.,
486 Arvin Avenue,
Stoney Creek, Ontario
L8G 3X9

Fulton Aluminum Foundry,
77 Fulton Road,
Brantford, Ontario
N3R 4E8

Galt Aluminum Castings,
P.O. Box 43,
Cambridge, Ontario
N3H 4S1

Gamma Foundry Co. Ltd.,
75 Newkirk Road,
Richmond Hill, Ontario
L4C 3G4

Grenville Castings Ltd.,
Montague Street,
Merrickville, Ontario
KCG 1N0

H. & E. Castings Ltd.,
240 Bunting Road,
St. Catharines, Ontario
L2M 3X1

Haley Industries,
Haley,
Ontario

Hamilton Matchplate Co.,
265 Lettridge Street North,
Hamilton, Ontario
L8L 6W1

Harrington Aluminum Foundry Ltd.,
145 Main Street,
Woodstock, Ontario
N4S 1T1

Hoselton Studios,
P.O. Box 130,
Colbourne, Ontario
K0K 1S0

Jamaica Manufacturing (Can.) Co. Ltd.,
P.O. Box 640,
Corinne Street,
Prescott, Ontario
K0E 1T0

James H. Matthews & Co.,
71 Nipissing Road,
Milton, Ontario
L9T 1R4

John Aluminum & Brass Foundry,
P.O. Box 1082,
34 Charlton Avenue,
Brantford, Ontario
W3T 5S7

K.P. Bronze Co. Ltd.,
23 Harlech Court,
Thornhill, Ontario
L3T 2A1

Keleher Foundry,
3 Victoria Road South,
Guelph, Ontario
N1E 5P4

Kerns' Aluminum, Bronze Foundry,
6th Concession & North Town Line,
Anderton Township - R.R. 1,
Windsor, Ontario
N9A 6J3

Kilby Foundry,
360 East Street,
Orillia, Ontario
L3V 4C5

Klassen Bronze Ltd.,
73 Hinks Street,
New Hamburg, Ontario
NOB 2G0

T.C. Lawrence & Sons Ltd.,
17 Jarvis Street,
Cambridge, Ontario
N1R 1G7

Long Branch Foundry,
33 Magnificent Road,
Toronto, Ontario
M8Z 4T4

Machine-O-Matic,
430 Comstock Road,
Scarborough, Ontario
M1L 2H6

May Foundry Co. Ltd.,
6029 Clarke Avenue,
Niagara Falls, Ontario
L2G 3W3

Meteor Foundry Co. Ltd.,
14 Canso Road,
Rexdale, Ontario
M9W 4L8

McGraw-Edison of Canada Ltd.,
Power Systems Division,
3595 St. Clair Avenue East,
Scarborough, Ontario
MLK 1M1

Mills Lighthouse Ltd.,
99 Ashley Street,
Hamilton, Ontario
L8L 7W1

Monarch Fabricating & Die Casters Ltd.,
45 Colville Road,
Toronto, Ontario
M6M 2Y2

Mueller Ltd.,
P.O. Box 3003,
Sarnia, Ontario

Niagara Bronze Ltd.,
P.O. Box 838,
4248 Broughton Avenue,
Niagara Falls, Ontario
L2E 3K7

Non-Ferrous Castings Ltd.,
1821 Mattawa Avenue,
Mississauga, Ontario
L4X 1K6

Pal Foundries Ltd.,
40 Nugget Avenue,
Agincourt, Ontario
M1S 3A8

Pattern Engineering Co. Ltd.,
37 LePage Court,
Downsview, Ontario
M3J 2A2

Proto-Castings (Orangeville),
36 Robb Boulevard,
Orangeville, Ontario
L9W 3L2

Quality Aluminum Castings Ltd.,
15 Selby Road,
Brampton, Ontario
L6W 1J5

Rahn Metals & Plastics Ltd.,
P.O. Box 168,
141 Regina Street,
North Bay, Ontario
PLA 1A1

Riverside Brass & Aluminum Foundry Ltd.,
P.O. Box 714,
New Hamburg, Ontario
NOB 2G0

Joseph Robertson Foundries Ltd.,
52 Milford Avenue,
Toronto, Ontario
M6M 2V8

J. Robinson & Son,
2 Hinton Avenue North,
Ottawa, Ontario
K1Y 0Z6

Roto-Cast Ltd.,
721 Eastern Avenue,
Toronto, Ontario
M4M 1E6

Saltfleet Aluminum Foundry Ltd.,
328 Lake Avenue West,
Hamilton, Ontario
L8G 3A2

Skara Metal Foundry,
94 - 26th Street,
Toronto, Ontario
M8V 3S1

Slater Products,
Division of Slater Steel Industries Ltd.,
P.O. Box 271, Station A.,
Hamilton, Ontario
L8N 3E7

Soo Foundry & Machine Co. Ltd.,
457 Bay Street,
Box 459,
Sault Ste. Marie, Ontario
P6A 5M1

Standard Brass & Aluminum Co. Ltd.,
550 York Road,
P.O. Box 215,
Guelph, Ontario
N1H 6J9

Stoermer Bell & Brass Foundry,
P.O. Box 2,
Breslau, Ontario
NOB 1M0

Sully Castings Ltd.,
225 Centre Street East,
Richmond Hill, Ontario
L4C 1A7

A.H. Tallman Bronze Co. Ltd.,
2220 Industrial Street,
P.O. Box 5014,
Burlington, Ontario
L7R 3Y8

Uxbridge Foundry,
283 King Street West,
Toronto, Ontario
M5V 1J1

West Bend of Canada,
Brampton Division,
89 Heart Lake Road,
Brampton, Ontario

Wilson & Cousins Co. Ltd.,
145 Orenda Road,
Brampton, Ontario
L6W 1W4

Wilson Brass & Aluminum Foundries Ltd.,
205 Nantucket Boulevard,
Scarborough, Ontario
M1P 2P2

ITT Grinnell Co. of Canada,
2440 Dundas Street West,
Toronto, Ontario
M6P 1X1

International Hardware Co. of Canada Ltd.,
180 Coleman Street,
Belleville, Ontario
K8N 5A8

Wolverine Brass Co. Ltd.,
918 Palmerston Avenue,
Toronto, Ontario
M6G 2S6

G.S.M. Management Ltd.,
Woodings Canada Division,
P.O. Box 52,
South Lancaster, Ontario
KOC 2C0

PRAIRIE REGION

Steel Foundries

Abex Industries Ltd.,
Amsco Joliette Div.,
35 Mercy Street,
Selkirk, Manitoba
R1A 1N5

Foothills Steel Foundry Div.,
Irving Industries Ltd.,
6711 Fairmount Drive, S.E.,
Calgary, Alberta
T2H 0X6

Griffin Steel Foundries Ltd.,
P.O. Box 241,
Transcona,
Winnipeg, Manitoba
R2C 2F9

Quality Steel Foundries Ltd.,
10340 - 58th Avenue,
Edmonton, Alberta
T6H 1B5

Iron Foundries

Ancast Industries Ltd. (Ductile Iron only)
1356 Saskatchewan Avenue,
Winnipeg, Manitoba
R3E 0L2

Blanchard Foundry Co.,
821 - 47th Street,
P.O. Box 1444,
Saskatoon, Saskatchewan

Canron Ltd.,
Pipe Division,
P.O. Box 1090,
Main Post Office,
Calgary, Alberta
T2P 2K9

Dominion Bridge Co. Ltd.,
P.O. Box 400,
107th Avenue and 120th Street,
Edmonton, Alberta
T5J 2J6

A-1 Steel and Iron Foundry Division,
Ardiem Corp.,
822 - 51st Street East,
Saskatoon, Saskatchewan

Lethbridge Iron Works Co. Ltd.,
720 - 32nd Street,
P.O. Box 967,
Lethbridge, Alberta
T1T 4A2

Monarch Industries Ltd.,
Winkler,
Manitoba

Norwood Foundry (Sask.) Ltd.,
1240 Second Avenue,
P.O. Box 1455,
Regina, Saskatchewan
S4P 3G2

Norwood Foundry Ltd.,
Nisku Industrial Park,
Imperial Avenue,
Nisku, Alberta
TOC 2G0

Norwood Foundry Ltd.,
9111 - 111th Avenue,
Edmonton, Alberta

Sovereign Castings Ltd.,
P.O. Box 5122,
Station "A",
Calgary, Alberta
T2H 1X3

Teledyne Canada Bell Foundry,
1770 Sargent Avenue, (Ductile Iron Only)
Winnipeg, Manitoba
R3H 0S8

Thor Foundry,
54 Archibald Street,
Winnipeg, Manitoba
R2J 0V8

Titan Foundry Ltd.,
9520 - 125th Avenue,
Edmonton, Alberta
T5G 0W4

Newbery Energy Ltd.,
Castings Div.,
P.O. Box 10,
Saskatoon, Saskatchewan
S7K 3K1

Heritage Foundry Ltd.,
P.O. Box 1779,
Winkler, Manitoba
R0G 2X0

McAvity Crane Canada Ltd.,
P.O. Box 1000,
Medicine Hat, Alberta
T1A 7H1

Non-Ferrous Foundries

American Brass & Aluminum Foundry Ltd.,
12520 - 123rd Street,
P.O. Box 3528, Station "D",
Edmonton, Alberta
T5L 4J3

Bay Bronze Ltd.,
2200 Logan Avenue,
Winnipeg, Manitoba
R2R 0OZ

Behrends Bronze Ltd.,
5914 - 87th Street,
Edmonton, Alberta
T6E 2Y4

Canadian Bronze Co. Ltd.,
15 Bury Street,
Winnipeg, Manitoba
R3E 2X7

Custom Aluminum Castings Ltd.,
1501 Clarence Avenue,
Winnipeg, Manitoba
R3T 1T5

Micron Foundry Ltd.,
12850 - 56th Street S.E.,
Edmonton, Alberta

Norwood Foundry Ltd.,
Southside Div.,
10054 - 79th Avenue,
Edmonton, Alberta

Spartacan Foundry Ltd.,
1732 - 41st Avenue S.E.,
Calgary, Alberta
T2G 1Y1

BRITISH COLUMBIA

Steel Foundries

A-1 Steel Foundry,
Division of Ardiem Industrial Corp.,
1660 Station Street,
Vancouver, B.C.
V6A 2Y1

C.A.E. Machinery Ltd.,
3550 East Broadway,
Vancouver, B.C.
V5M 2A3

Cominco Ltd.,
Central Shops,
Trail, B.C.
V1R 4L5

Esco Ltd.,
1855 Kinsway,
Port Coquitlam,
B.C.

Kockums Industries Ltd.,
13050 - 88th Avenue,
Surrey, B.C.
V3W 3K4

Reliance Foundry Co. Ltd.,
7764 - 129A Street,
Surrey, B.C.
V3W 4H7

Victoria Machinery Depot Co. Ltd.,
343 Bay Street,
P.O. Box 670,
Victoria, B.C.
V8W 2F3

Iron Foundries

Associated Foundry Ltd.,
7909 - 132nd Street,
P.O. Box 9005,
Surrey, B.C.
V3T 4X3

Century Pacific Foundry Ltd.,
8239 - 128th Street,
Surrey, B.C.
V3W 4G1

Highland Foundry Ltd.,
9670 - 187th Street,
Surrey, B.C.
V3T 4W2

McLean & Powell Iron Works Ltd.,
398 West 2nd Avenue,
Vancouver, B.C.
V5Y 1C8

Mainland Elworthy Division,
Bow Valley Resources Services Ltd.,
1510 River Road,
Richmond, B.C.

Nye's Foundry Co. Ltd.,
503 Powell Street,
Vancouver, B.C.
V6A 1G8

Peach City Foundry (1973) Ltd.,
1363 Commercial Way,
Penticton, B.C.
V2A 3H4

Robar Industries Ltd.,
12945 - 78th Street,
Surrey, B.C.
V3W 2X8

Terminal City Iron Works Ltd.,
1909 Franklin Street,
Vancouver, B.C.
V5L 1R1

Thompson Foundry Ltd.,
12440 - 82nd Avenue,
Surrey, B.C.
V3W 3E9

Victoria Foundries Ltd.,
622 Pembroke Street,
Victoria, B.C.
V8T 1H6

Non-Ferrous Foundries

Advance Foundry Ltd.,
235 Clark Drive,
Vancouver, B.C.
V5L 3H3

Fourway Foundry Ltd.,
1055 E. Cordova,
Vancouver, B.C.
V6A 1M8

Globe Foundry Ltd.,
7647 Willard Street,
New Westminster, B.C.
V3N 2W2

Mako Foundry Ltd.,
1205 Glen Avenue,
Vancouver, B.C.

Ornamental Bronze Co. Ltd.,
380 Olafson Avenue,
Richmond, B.C.
V6X 2R3

Osborne Propellers Ltd.,
1645W - 1st Avenue,
Vancouver, B.C.

Pacific Bronze Co.,
244 Woodland Drive,
Vancouver, B.C.
V5L 3P5

Seymour Industries Ltd.,
4641 Byrne Road,
South Burnaby, B.C.
V5J 3H6

Sumner Brass Foundry Ltd.,
1701 West Georgia Street,
Vancouver, B.C.
V6G 2V6

Vancouver Island Brass Foundry Ltd.,
638 Pembroke Street,
Victoria, B.C.
V8T 1H6

ROBERT SHNAY & ASSOCIATES LTD.

Consultants

3478 GREY AVE.
MONTREAL, QUE.
H4A 3N8

TEL (514) 481-3066

August 18, 1982

Dear Sir,

The Department of Energy, Mines and Resources has retained us to investigate and report on the past, present and projected consumption of moulding and core sands. The major objective of this study is to provide data which can eventually lead to the development of more Canadian sources of foundry sands.

We believe that the ultimate goals of reducing our dependence on imported supplies, and also reducing transportation costs will be of significant benefit to the Canadian Foundry Industry.

Your cooperation in completing the questionnaire on the reverse side of this letter will be greatly appreciated. A return envelope has been enclosed for your convenience.

Yours truly,



R.C. Shnay, P. Eng.
President

(over)

RCS:dn

SAND CONSUMPTION SURVEY

COMPANY _____

CONTACT _____

NAME _____

POSITION _____

ADDRESS _____

Metals or Alloys Cast

TELEPHONE () _____

SAND TYPE or SOURCE	AFS NO.	APPLICATION	PROCESS or BINDER	ANNUAL CONSUMPTION (TONS)		
				1977/81	1982	1983/9

Future Consumption: Please provide details of any expected changes in your operations which will have a significant effect on the type and amount of sand you buy.

NOTES: Sand type - Silica, Olivene, Zircon, Ottawa, New Jersey, etc..
 AFS No. - Grain fineness number or suppliers designation.
 Application - Cores, Moulds, chill, etc..
 Process or binder - Green sand, shell, air-set, etc..

ROBERT SHNAY & ASSOCIÉS LTÉE.

3478, AVE. GREY

MONTRÉAL, QUÉ.

H4A 3N6

TEL (514) 481-3066

le 20 août, 1982

Monsieur,

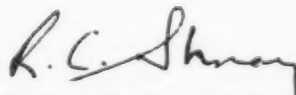
Le Ministère de l'Energie, des Mines et des Ressources à Ottawa a retenu nos services pour la réalisation d'une enquête afin de déterminer la consommation de sable d'importation et du pays utilisé par les fonderies canadiennes au présent, dans les cinq années précédentes et qui sera utilisé dans les dix prochaines années.

Les buts finals sont de réduire les importations ainsi que de diminuer les frais de transport. Le succès de cette enquête et les bénéfices qui en découleront pour votre industrie dépendent de votre coopération.

Vous êtes donc priés de répondre au questionnaire au verso.

Nous avons inclus une enveloppe avec l'adresse de l'expéditeur.

Dans l'attente d'une réponse, je vous prie monsieur, d'agréer mes sentiments distingués.



R.C. Shnay, ing.
Président

RCS:dp

(au verso S.V.P.)

ENQUETE SUR LA CONSOMMATION DE SABLE

COMPAGNIE _____

CONTACT

NOM _____

ADRESSE _____

POSTE _____

Métaux ou Alliages

Téléphone () _____

TYPE OU SOURCE
DE SABLE

NO
AFS

EMPLOI

PROCESSUS

CONSOMMATION ANUELLE
TONS

1977/81

1982

1983/9

Si vous prévoyez des changements importants dans la consommation du sable
veuillez nous en fournir les détails.

Par exemple: l'installation de récupération.

NOTES: Type ou source de sable - Silica, Olivene, Ottawa, etc..
Emploi - moulage, noyautage, chill, etc..
Processus - green sand, air-set, shell, etc..

ROBERT SHNAY & ASSOCIATES LTD.

Consultants

3478 GREY AVE.
MONTREAL, QUE.
H4A 3N6

TEL (514) 481-3068

August 10, 1982

TO: FOUNDRY SAND SUPPLIERS

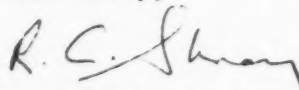
SAND CONSUMPTION SURVEY

We have been retained by the Department of Energy, Mines and Resources to investigate and report on the consumption of moulding and core sands in Canada. The ultimate goal of this study is to provide data which will help to develop Canadian resources.

It would be appreciated if you would assist us by filling in the questionnaire on the other side of this page. A return envelope has been enclosed for your convenience.

Descriptive literature covering the sands you sell or distribute would be very helpful.

Yours truly,



R. C. Shnay, P. Eng.
President

/(over)

COMPANY	WHAT SANDS DO YOU SELL OR DISTRIBUTE?	SOURCE
ADDRESS		
TEL.: ()		
CONTACT: NAME		
POSITION		

ESTIMATED ANNUAL CONSUMPTION OF SILICA SANDS

PROVINCE OR REGION	1977 to 1981		1982		1983 - 1992	
	TONS	* \$	TONS	* \$	TONS	* \$
ATLANTIC						
QUEBEC						
ONTARIO						
PRAIRIES						
B.C.						

* In the case of resin-coated sands, please deduct the value of the coating.

Please note that we are not asking for your company's sales, but rather your estimate of the market.

NOTE: Descriptive material and current price lists would be appreciated.

APPENDIX 4

SUMMARY OF FOUNDRY QUESTIONNAIRE DATA

C.1 ATLANTIC REGION

NAME AND ADDRESS	TYPE OF SAND (AFS FINENESS NO.)	AVERAGE ANNUAL CONSUMPTION (TONS)		
		1977-1981	1982	1983-1992
(a) Iron The Enterprise Foundry Co. Lorne Street, Sackville, N.B. EOH 3C0 Saint John Foundry Ltd. P.O. Box 2025, St. John, N.B. E2L 3T5	Albany No. 1 New Jersey Silica - (59)	490 200	420 -	500 -
	Ottawa District - (55)	200	60 recla- mation	400
(b) Copper base Canadian National Railways Barber Street, Moncton, N.B.	Ottawa District Silica-(63)	225-300	300	225-300
(c) Aluminum, Copper and Zinc Alloys 4-D Enterprises, 80 Henri-Dunant Street, Moncton, N.B. E1E 1E6	Ottawa District Silica - (140)	5	4	5

C.2 QUEBEC

NAME AND ADDRESS	TYPE OF SAND (AFS FINENESS NO.)	AVERAGE ANNUAL CONSUMPTION (TONS)		
		1977-1981	1982	1983-1992
(a) Steel Carbon and Low Alloy Canadian Steel Foundries 5227 Notre-Dame East, Montreal Unitcast of Canada, 455 Belvedere Sud, Sherbrooke, J1H 5K2 Carbon and Low Alloy, Manganese Steels Metallurgie Frontenac 500 Smith Blvd. N. Thetford Mines, G6G 5S9 Carbon and Low Alloy Stainless Steel Irons Dominion Engineering Works Ltd. P.O. Box 220 Montreal H3C 2S5 Manganese and Low Alloy Abex Industries Ltd. 620 Laval Street, Joliette, Quebec J6C 6H5	Ottawa District Silica - (55-65) Chromite - (55-65) Zircon - (100-120) Ottawa District Silica - (62) Ottawa District Silica - (48-52) Ottawa District Silica - (50) Chromite - (55-60) Ottawa District Silica - (62) Olivine - (70) Zircon - (91) Chromite - (55-65)	8,500 5,000 5,000 3,200 12,000 360 2,300 5,200 625 10	4,100 4,400 2,500 1,800 4,000 150 2,300 5,000 400 -	7,800 4,500 2,500 2,700 2,000 360 (Increased Reclamation) 2,500 5,500 500 -

Quebec - Iron

NAME AND ADDRESS	TYPE OF SAND (AFS FINENESS NO.)	AVERAGE ANNUAL CONSUMPTION (TONS)		
		1977-1981	1982	1983-1992
(b) Iron				
Belgen Inc. 4475 Blvd. St. Joseph Drummondville	Ottawa District Silica - (55)	1,000	1,000	1,000
Canron Inc. 195 St. Maurice Street Trois Rivières	Des Forges Silica - (43)	3,000	3,000	3,000
Fonderie Carmi Inc. 621 Rang St. Charles, St. Thomas, Co.Joliette	Ottawa District Silica -	100	40	48
Darling Duro Ltée. 140 rue Prince, Montreal, H3C 2N2	Ottawa District Silica - (55) Zircon	525	500	550
Fontac Inc. 8850 Boul. Parent, Trois Rivières, G9A 5E1	Des Forges Silica -	3	3	4
Forano Inc. 1600 St. Paul Plessisville G6L 2Y9	Plessisville Silica (55) Ottawa Distric Silica - (55)	3,000 10	2,500 10	3,000 15 (Reclamati,
Fonderie Fortin R.R. 112, Waterloo,	Ottawa District Silica - (55)	50	100	100
Fonderie Laperle Ltée. Chemin des Patriotes St. Ours, Co. Richelieu	Ottawa District Silica - (55)	1,150	1,500	2,000

Quebec - Iron

NAME AND ADDRESS	TYPE OF SAND (AFS FINENESS NO.)	AVERAGE ANNUAL CONSUMPTION (TONS)		
		1977-1981	1982	1983-1992
Magogteaux Canada, 601 Champlain, Magog	Ottawa District Silica - (55)	1,000	2,250	2,600
Metallurgie Karby, St. Pierre, Co. Montmagny	Ottawa District Silica - (140) Des Forges Silica - (70)	5 40		
Noranda Norcast Div. 105 de la Fonderie, Mont-Joli	Ottawa District Silica -	3,000	3,400	3,500
Fonderie Saguenay 2001 Boul. Talbot, Chicoutimi	Des Forges Silica	5,000	3,500	6,000
Fonderie Ste. Croix, 6200 rue Principale, Ste. Croix Co. Lotbinière	Ottawa District Silica - (60)	3,500	2,100	2,500 (Reclamati
La Fonderie Stanton, 5335 rue Ramsay, St. Hubert	Ottawa District Silica - (55)	10,000	3,000	1,000 (Reclamati
La Fonderie de Thetford, 700 Notre-Dame N. Thetford Mines	Ottawa District Silica - (65)	550	950	1,200
(c) Non-Ferrous Copper-Base				
Canadian Stone Marine P.O. Box 86 Iberville, J2X 4J8	Ottawa District Silica - (34)	1,200	750	1,000-1,25

Quebec - Non-Ferrous

NAME AND ADDRESS	TYPE OF SAND (AFS FINENESS No.)	AVERAGE ANNUAL CONSUMPTION (TONS)			
		1977-1981	1982	1983-1992	
Les Industries Cuthbrite 47 Duke Street, Montreal H3C 2L9	McConnellsville - (120) Ottawa District Silica - (50)	100 75	75 50	100 100	
La Fonderie St. Anselme, St. Anselme, Co. Dorchester, GOR 2N0	Des Forges Ottawa District Silica - (60)}	50	200	200	
Copper-Base and Aluminum					
Aubertin Fonderie Ltée. 10101 rue Hébert, Montreal Nord	Ottawa District Silica - (140)	75	90	90	
Fondremy, 1455 Boul. Industriel, Chambly, J3C 4C4	Ottawa District Silica - (55) Olivine - (120)	50 -	100 30	80 30	
Fonderie St.-Romuald, P.O. Box 2008, St.-Romuald, G6W 5M3	Olivine - (120) Ottawa District Silica - (75) Ottawa District Silica - (140)	200 1,000 60	150 1,200 40	300 500* 70 *Reclama tion)	
Industries USP Inc., 72 rue Queen, Lennoxville,	McConnellsville - Ottawa District Silica - Zircon - Chromite -	53 240 4 1	53 240 4 1	53 240 4 1	

Quebec - Non-Ferrous

NAME AND ADDRESS	TYPE OF SAND (AFS FINENESS No.)	AVERAGE ANNUAL CONSUMPTION (TONS)		
		1977-1981	1982	1983-1992
Aluminum Alloys				
GTE-Sylvania, 760 Notre-Dame, St.-Remi, JOL 2LO	Ottawa District Silica - (140)	45	50	50
Lumec Inc., 618 Curé Boivin, Boisbriand, Québec	Albany - (65)	2½	3	5
Manville Canada Inc., 17200 Centrale, St. Hyacinthe,	Olivine - (180) Ottawa District Silica - (75)	13 10	10 6	10 8
Société Pola-Lite, 1 Boul. Edouard Vll LaPrairie, JOL 2KO	Ottawa District Silica - (140) Ottawa District Silica - (65)	12 100	15 80	
Iron, Copper and Aluminum Alloys				
Fonderie Grand'Mère, B.P. 336, Grand'Mère	Albany Des Forges	80 175-200	80 175	
Iron and Bronze				
Jenkins Canada Inc., 170 Blvd. St. Joseph, Lachine, H8S 2L6	Ottawa District Silica - (65) } Ottawa District Silica - (120) } Ottawa District Silica - (180) }	3,500	3,500	3,000 (Reclamatio

C.3 ONTARIO

NAME AND ADDRESS	TYPE OF SAND (AFS FINENESS No.)	AVERAGE ANNUAL CONSUMPTION (TONS)		
		1977-1981	1982	1983-1992
(a) Steel Carbon and Low Alloy				
Esco Ltd., P.O. Box 270,	Ottawa District Silica - (56) Ottawa District Silica - (71)	400 181 (Reclamation)	400 110	800 300
Carbon, Low Alloy and High Alloy				
Dofasco Inc., P.O. Box 460, Hamilton, L8N 3J5	Martin Marietta - (60) Ottawa District Silica - (62.8)	31,560	18,000 (Reclamation)	13,600
	Zircon - (85-95) Chromite - (55.6) Olivine - (70)	1,110 2,760 38	1,950 40	1,200 2,920 15
Specialty Steels and High Alloys				
Magalloy Ltd., 110 Pine Street, Stratford, N5A 1W3	Ottawa District Silica - (55)	1,400	900	1,000 (Reclamation)
All Grades of Steel Iron				
Alloy Castings Ltd., 3741 Hamilton Road, New Hamburg	Portage Silica - (50)	1,200	1,500	3,000
Melmet Industries Ltd., P.O. Box 370 Welland, L3B 5R1	Ottawa District Silica - (55-60) Lake	2,000 450	1,800 300	2,000 300

Ontario - Steel

NAME AND ADDRESS	TYPE OF SAND (AFS FINENESS NO.)	AVERAGE ANNUAL CONSUMPTION (TONS)		
		1977-1981	1982	1983-1992
Carbon Steels, Iron and Non-Ferrous				
Algoma Steel Corp. Queen Street West Sault Ste. Marie	Portage Silica - (43)	6,000	3,700	4,000
(b) Iron				
A.G. Anderson Ltd. 3040 Osler Street, London,	Lake - (49)	150 (Reclamation)	200	200
S.A. Armstrong 20 Hanna Court, Belleville	Lake - (45)		2,500	
H. Imbleau & Son Ltd. 11 Bridge Street, Renfrew	New Jersey - (45) New Jersey - (70)	100 130	100 130	150 180
Benn Iron Foundry Ltd. 4 Mason Street, Wallaceburg N8A 4M1	Lake - (52) Bank - (103) Ottawa District Silica - (75)	777 612 1,377	838 423 1,182	777 612 1,377
Birla Industries Ltd. P.O. Box 3400, Windsor N8N 3C4	Lake sand - (63)	7,000	4,000	8,000
Bowmanville Foundry P.O. Box 69 Bowmanville L1C 3K8	McConnellsville - (75) Ottawa District Silica - (75)	185 34	108 24	108 34
Brown Foundry Ltd. Morrisburg KOC 1X0	Ottawa District Silica - (70)	1,307	1,000	1,350
Canron Inc. Ingot Mould Fdry. Hamilton L8N 3C8	Lake - (52)	19,181	11,364	14,000

Ontario - Iron

NAME AND ADDRESS	TYPE OF SAND (AFS FINENESS NO.)	AVERAGE ANNUAL CONSUMPTION (TONS)		
		1977-1981	1982	1983-1992
Canron Inc. Stuart Street Plant, Hamilton, Ontario	Ottawa District Silica - (75) Lake - (50-52) Ottawa District Silica - (65) Lake - (50)	3,500 5,800 60 3,920	3,200 3,800 55 4,900	3,400 5,000 58 4,410
Canron Inc. P.O. Box 1510, New Liskeard				
Crawford Machine and Foundry Ltd. P.O. Box 66, Woodstock, N4S 7W5	Ottawa District Silica - (65)	166	130	
Crowe Foundry Ltd. 95 Sheffield Street, Cambridge	Ottawa District Silica - (51) Lake sand - (58)	604	1,010	1,010
Crowle Fittings Ltd. 88 Fenmar Drive, Weston M9L 1M5	New Jersey - (70) Ottawa District Silica - (75)	100 720	10 125	
Cunningham Foundries Ltd. 21 Yale Crescent, St. Catharines L2R 2Y6	Lake - (55) Chromite - Ottawa District Silica	15,000 (Reclamation)	1,000 50	2,000 100
Date Industries Ltd. 68 Swan Street, Ayr NOB 1E0	Ottawa District Silica - (63) Ottawa District Silica - (51) Ottawa District Silica - (140)	609 18	519 10	
J.R. Ferguson Co. Ltd. Box 8588, Dundas L9H 5G1	New Jersey - (70) Local fine	70 175	40 150	
Findlay Foundry Ltd. P.O. Box 250, Carleton Place K7C 3P4	Ottawa District Silica - (66)	100	120	150

Ontario - Iron

NAME AND ADDRESS	TYPE OF SAND (AFS FINENESS NO.)	AVERAGE ANNUAL CONSUMPTION (TONS)		
		1977-1981	1982	1983-1992
Ford Motor Co. P.O. Box 1620 Windsor, N9A 2S5	Lake sand - (43-51) Bank sand - (85-95)	45,000 100,000	45,000 20,000	45,000 20,000
General Motors of Canada Ltd. Foundry Plant, 570 Glendale Avenue, St. Catharines	Lake sand - (48)	108,331	101,959	104,800
Holmes Foundry, P.O. Box 970, Sarnia N7T 5M5	Lake sand - (50)	28,000	17,000	27,600
International Malleable Iron Co. Ltd. P.O. Box 180, Guelph	Ottawa District Silica - (55)	2,000	2,000	2,500
Kanmet Div. of Massey Ferguson, P.O. Box 3220, Cambridge, N3H 4S9	Lake sand - (47-51) Ottawa District Silica - (60) Bank - (90-130)	4,578 372 423	2,697 112 114	3,500 120 200
Kelsey Hayes Can. Ltd. P.O. Box 300, Woodstock, N4S 7X8	Lake sand - (47-51) Bank - (72) Rockwood Silica - (54) Lake sand - (54) Lake sand - (58)	2,380 800 650 1.5 10	2,470 1,000 280 5 10	3,000 1,200 400 20 20

Ontario - Iron

NAME AND ADDRESS	TYPE OF SAND (AFS FINENESS NO.)	AVERAGE ANNUAL CONSUMPTION (TONS)		
		1977-1981	1982	1983-1992
Massey Ferguson Inc. Ltd. Greenwich Street, Brantford	Lake sand - (50) Bank sand - (90-100) Lake sand - (65) Ottawa District Silica - (75) Chromite - (55-85)	9,200 5,000 1,400 300 50	3,000 1,900 500 90 6	4,000 2,500 1,100 100 30
McLean Foundry Ltd. 247 Colborne St. W., Brantford	Lake sand -	3,300	3,000	2,500
Rockwell International 40 Wellington Street, Guelph N1H 6M7	Ottawa District Silica - (50) Bank sand - (95)	230 155	210 190	240 190
Standard Induction Castings 3827 Peter Street, Windsor N9C 1K3	Ottawa District Silica - (61.5) Bank sand - (75) Ottawa District Silica - (51)	230 47 122	275 85 78	400 100 80
Western Foundry Co. 454 Industrial Road, Wingham NOG 2W0	Ottawa District Silica - (51) Ottawa District Silica - (75)	1,700 100	2,000 120	5,000 250
Bibby Foundry Ltd. P.O. Box 279, Cambridge N1R 5T8	Lake sand - (58)	1,800	1,800	1,800

Ontario - Iron

NAME AND ADDRESS	TYPE OF SAND (AFS FINENESS NO.)	AVERAGE ANNUAL CONSUMPTION (TONS)		
		1977-1981	1982	1983-1992
Iron and Non-Ferrous				
Alloy Foundry Co. Ltd., P.O. Box 130, Merrickville K0G 1N0	New Jersey - (70) Lake sand - (47-51)	120 25	60 50	
Summerstown Metals Ltd., Summerstown, Ontario	Ottawa District Silica - (110)	20	20	30
Welland Iron & Brass Ltd., 130 Niagara Street, Welland L3C 1H3	Lake sand - (55)		2,982	(Reclamation)
(c) Non-Ferrous Copper Alloys				
Cambridge Brass, 140 Orien, Cambridge, N1R 5V1	McConnellsville - (130) Ottawa District Silica - (70)	160 500	120 250	
Crane Canada, 254 Henry Street, Brantford N3T 5T7	Ottawa District Silica - (75) McConnellsville - (110) McConnellsville - (90)	200 60 50	200 60 50	250 70 50
Enhart Canada Ltd. Int. Hardware Div. 180 Coleman Street, Belleville K8N 5A8	Olivine		18	21
ITT Grinnell 3440 Dundas Street, Toronto M6P 1X1	Ottawa District Silica - (55) Lake sand - (48-52)	1,055 1,613	557 789	
Mueller Ltd., Box 3003, Sarnia N7T 7M4	Bank sand - (130) Ottawa District Silica - (75)	15 50	13 35	15 50

Ontario - Non-Ferrous

NAME AND ADDRESS	TYPE OF SAND (AFS FINENESS NO.)	AVERAGE ANNUAL CONSUMPTION (TONS)		
		1977-1981	1982	1983-1992
Copper-Base and Aluminum Alloys	DCM Foundry Ltd. 11 Garfield Avenue, London, N6C 2B4	5 8	6 4	6 8
	GSP Management, P.O. Box 1209, Alexandria KOC 1A0	15 15 73	10 10 63	
	Johns Aluminum and Brass Foundry, P.O. Box 1082,			
	Niagara Bronze, P.O. Box 838, Niagara Falls L2E 6V6	12 8	10 6	12 8
	Stoermer Bell & Brass Foundry, P.O. Box 2, Breslau NOB 1M0	1	$\frac{1}{2}$	3
	A.H. Tallman Bronze Co. Ltd. P.O. Box 5014, Burlington L7R 3Y8	415	225	400
	Wilson Brass & Aluminum Foundries Ltd., 205 Nantucket Blvd., Scarborough M1P 2P2		50 45 90	50 45 90
	Ottawa District Silica - (70)			
	Ottawa District Silica - (75) Ottawa District Silica - (140) Ottawa District Silica - (100)			
	Ottawa District Silica - McConnellsville- (130)			
	Olivine - (120)			
	Local			
	Ottawa District Silica - (53.1)			
	Olivine - (120) Ottawa District Silica - (60) Lake sand - (55)			

Ontario - Non-Ferrous

NAME AND ADDRESS	TYPE OF SAND (AFS FINENESS NO.)	AVERAGE ANNUAL CONSUMPTION (TONS)		
		1977-1981	1982	1983-1992
Copper-Base, Aluminum Alloys, Irons & Alloy Steels				
Burnstein Castings Ltd. 69 Catherine Street,	Olivine - (120) Lake sand -	100 500	100 100	140 100
Corbron Foundries Ltd., P.O. Box 1119, Cornwall, K6H 5V2	Ottawa District Silica - (65)		1,500	
Johnson Matthey Ltd., P.O. Box 367, St. Catharines	Ottawa District Silica - (75) Bank sand - (120) Chromite - (55-65) Ottawa District Silica - (80)	125 175 22 154	125 100 4 105	125 120 12 137
Aluminum & Zinc Alloys				
Meteor Foundry Co. Ltd. 1730 Bonhill Road, Mississauga	Olivine - (120) Olivine - (200) Ottawa District Silica - (50) Ottawa District Silica - (75)	22 2 84 58	19 1 130 25	22 100 50
Aluminum - Perm.Mould Shell Cores				
Grenville Castings Ltd., P.O. Box 100, Merrickville	Silica	41	38	41

C.4 PRAIRIE REGION

NAME AND ADDRESS	TYPE OF SAND (AFS FINENESS NO.)	AVERAGE ANNUAL CONSUMPTION (TONS)		
		1977-1981	1982	1983-1992
(a) Steel Carbon and Low Alloy Griffin Canada Inc., 2500 Day Street, Winnipeg Quality Steel Foundries, 10340-58th Avenue, Edmonton T6J 1B8 Low Alloy, High Alloy, Manganese Steel, High Chromium Iron Abex Industries Ltd., 35 Mercy Street, Selkirk, Manitoba	Selkirk Silica - (50) Ottawa District Silica - (50) Selkirk Silica - (60) Zircon - (120) Olivine - (120) Chromite - (120)	3,750 420 7,000 2 70 5	3,200 560 4,900 - 150 5	4,000 7,500 2 50 5
(b) Iron Ancast Industries Ltd., 1350 Saskatchewan Avenue, Winnipeg, R3E 0L2 Blanchard Foundry, P.O. Box 1444, Saskatoon	Selkirk Silica - (50-60) Bank sand - (120) Selkirk Silica - (65)	1,215 (180 & 181 only) 710 (180 & 181 only) 450	1,800 10 520	2,450 - 550

Prairie Region - Iron

NAME AND ADDRESS	TYPE OF SAND (AFS FINENESS NO.)	AVERAGE ANNUAL CONSUMPTION (TONS)		
		1977-1981	1982	1983-1992
Dominion Bridge, P.O. Box 400, Edmonton, T5J 2J6	Olivine - {70} Olivine - {12} Ottawa District Silica - (30) Selkirk Silica - (50-60) Ottawa District Silica - (70-80)	250 30 100 32 10	80 - - 20 5	400 - - 215 15
Lethbridge Iron Works, P.O. Box 967, Lethbridge, T1J 4A2	Selkirk Silica -	645	550	590
Monarch Industries Ltd., P.O. Box 1090, Winkler, Manitoba	Selkirk Silica - (60)	450	500	600
A-1 Steel & Iron Div. Ardiem Corp., 824 - 51st Street E. Saskatoon	Selkirk Silica - (55) Olivine - (70)	- -	700 10	1,500 30
Newbery Energy Ltd., Castings Div. 240 - 103rd Street, Saskatoon S7K 3N9	Selkirk Silica - (45) Selkirk Silica - (50-55)	566 16	485 5	1,500 5
Norwood Foundry, 605-18th Avenue, Nisku, Alberta	Sil-Silica - (65)	3,465	2,590	
Teledyne Canada Bell Foundry, 31-1313 Border Street, Winnipeg, R3H 0X4	Selkirk Silica - {60} Selkirk Silica - {50}	1,200 700	700 520	1,400 800

C.5 BRITISH COLUMBIA

NAME AND ADDRESS	TYPE OF SAND (AFS FINENESS NO.)	AVERAGE ANNUAL CONSUMPTION (TONS)		
		1977-1981	1982	1983-1992
(a) Steel Low and High Alloy Manganese				
Esco Ltd., 1855 Kingsway, Port Coquitlam,	Ottawa District Silica - (52) Olivine - (70-75) Zircon - (105)	1,684 996 103	1,703 1,781 31	1,700 1,780 310 (Increase Reclamat
Carbon and Low Alloy High Alloy and Iron				
CAE Machinery Ltd., 3550 Lougheed Hwy., Vancouver	Ottawa District Silica - (59) Portage Silica - (59) Zircon - (70)	1,050 85	1,200 90	1,400 100
High Alloy & Irons				
Highland Foundry Ltd., 9670 - 187th Street, Surrey	Ottawa District Silica - (55) Olivine - (90)	600 240	600 240	
Low Alloy and Iron				
Mainland Manufacturing 15100 River Road, Richmond	Ottawa District Silica - (48) Chromite - (120)	2,400 240 (Reclamation)	1,200 120	
Victoria Machinery Depot, 343 Bay Street, Victoria V8T 1P5	Ottawa District Silica - (41) Ottawa District Silica - (35) Ottawa District Silica - (38) Zircon - (62)	400 20	460 20	

British Columbia - Iron

NAME AND ADDRESS	TYPE OF SAND (AFS FINENESS NO.)	AVERAGE ANNUAL CONSUMPTION (TONS)			
		1977-1981	1982	1983-1992	
Associated Foundry, P.O. Box 9005, Surrey, V3T 4X3	Olivine - (70)		100		100
Century Pacific Foundry Ltd., 8239-128th Street, Surrey, V3W 4G1	Olivine - (50) Portage - (52) Ottawa District Silica - (41)}		800		800
Robar Industries Ltd., 12945 - 78th Avenue, Surrey, V3W 2X8	Olivine - (70) Ottawa District Silica - (80)	250 40	330 27		400 40
Terminal City Iron Works Ltd., 1909 Franklin Street, Vancouver V5L 1R1	Ottawa District Silica - (84) Olivine - (60)	1,700 440	1,100 220		2,000 440
Iron, Steel & Non-Ferrous					
Cominco Ltd., Trail, B.C. V1R 4L8	Ottawa District Silica - (55) Chromite Olivine Zircon	500 35 50 5	300 35 50 5		350 35 50 5

British Columbia - Non-Ferrous

NAME AND ADDRESS	TYPE OF SAND (AFS FINENESS NO.)	AVERAGE ANNUAL CONSUMPTION (TONS)		
		1977-1981	1982	1983-1992
(c) Non-Ferrous Copper Alloys				
Osborne Propellers Ltd., 1645 West 1st Avenue, Vancouver V6J 1G2	Olivine - (70)	321	288	250
Copper and Aluminum Alloys				
Advance Foundry Ltd., 236 Clark Drive, Vancouver V5L 3H3	Ottawa District Silica - (120) Olivine - (120)	47 10		
Mako Foundry Ltd., 118 W. 2nd Avenue, Vancouver V5Y 1C3	Olivine - (120) Ottawa District Silica - (100)	20 25	20 25	20 25
Vancouver Island Brass Foundry Ltd., 638 Pembroke Street, Victoria V8T 1H6	Yellow Reba Portage (52)	10 10	10 10	15 15